

THE LEGACY OF HIROSHIMA

by Edward Teller with Allen Brown



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INTRODUCTION

THE CATASTROPHE of World War II could have been avoided. If we had not pressed for reparations after World War I, if we had used foreign aid as we are now using it, Hitler might never have come to power. If we had supported the League of Nations as we now are supporting the United Nations, lawless conquest would not have become rampant in the 1930s. If we had spent as much on military preparedness as we now are spending, Hitler could have been defeated in the first year of the war.

But what would have sufficed a few decades ago is not enough today. The world has become smaller; time has become shorter; changes and revolutions have become more frequent. And in Russian Communism we have met an opponent that is more powerful, more patient, and incomparably more dangerous than German Nazism.

What we are doing today would have seemed impossible in 1930. What we actually should be doing, similarly, seems beyond our reach at present. By being one generation behind our times, we are endangering peace; we may bring about World War III.

It has become necessary to create a lawful world community. Most people agree that our globe has become too small, too crowded, too dangerous to accommodate many sovereign governments—each of them a law unto itself. This is the chief obstacle to peace, the central problem of the world today. It is futile to

present a blueprint for the solution of this problem; it cannot be solved at one stroke. The solution requires many contributions from many quarters.

The main purpose of this book is to make my contribution to the cause of peace. I shall not limit myself to a single aspect of this problem. How to teach science, how to use science to conquer misery and provide more stability are questions that must be discussed and can be discussed in the spirit of hope.

Owing to my experience in the field of atomic explosives, it is proper that I should particularly emphasize the influence that these powerful instruments have on all questions of war and peace. One fact seems inescapable to me: It will not be possible to preserve peace unless we are willing to think carefully and in detail about war.

My contention is not that our preparation for war is insufficient. My main point is that our preparation is misdirected. We have been frightened by the display of our own power at Hiroshima, and we have lost our sense of proportion. On the one hand, we think of an all-out war as a cataclysm that will wipe out mankind. On the other hand, we think of an abolition of nuclear weapons as a means to restore stability and to avoid a future war. These two patterns of ideas are driving us toward a tragedy which, when it comes, will be of our own making.

There are a few points which are obvious, but which are rejected by the majority of our people.

In a dangerous world we cannot have peace unless we are strong.

We cannot be strong unless we are fully prepared to exploit the biggest modern power, nuclear explosives.

Nuclear weapons can be used with moderation on all scales of serious conflict. Nuclear weapons do not mean the end of the world, but they do mean the end of non-nuclear power.

World War III would be much worse than anything we can remember. But it would not destroy mankind. If we do not

prepare, it would do to us what wars have done to many nations. It would kill the United States.

The atomic age has brought fears, and it has brought a challenge. Unless we respond to the challenge, unless we create a world of tomorrow better than anything we can imagine or describe, too many of our fears will be justified.

The validity of these statements should be evident. Talking with my friends, reading books and newspapers, listening to the speeches of politicians and scientists have convinced me that the opposite of some of these statements is widely believed and that none of them are fully accepted. That is why these statements have been expanded into a book.

None of these statements can be proved. The world is much more involved than a mathematical demonstration. And, outside of mathematics, it is too often possible to prove both a statement and its opposite. So I shall not attempt to prove. I can only describe and discuss.

Much of the description will be personal. I am eager to state both my reasons and my motives. Much of the discussion will be detailed. Familiarity does help understanding, and details slow us down enough to prevent us from making false generalizations. Some of the conclusions will be erroneous; in discussing difficult questions, this is unavoidable. Yet I am fully convinced of the correctness of my statements, and I will present my conclusions in terms of my own full convictions.

not a single member of the wartime thermonuclear group continued to devote his full time and energy to advanced weapons. But the idea of a Super bomb did not die. A very small Los Alamos group headed by Robert Richtmyer kept the spark alive. From my base at the University of Chicago, I traveled to Los Alamos frequently during the years after Hiroshima to confer with Richtmyer's group. From the beginning, our thermonuclear work assumed a new direction and acquired a new style.

I am convinced that if, after Hiroshima, men of Oppenheimer's stature had lent their moral support—not their active participation, but only their moral support—to the thermonuclear effort, the United States would have shaved four years from the time it took this country to develop a Super bomb. But the thermonuclear work was given almost no support in the last months of 1945—or in 1946, 1947, or 1948. Many physicists and government officials were convinced that in the atomic bomb America had the weapon ideally suited for our policy of massive retaliation. The people were comforted by published pronouncements that Soviet Russia could not attain an atomic explosion for at least twenty years. Some leaders felt that work on advanced weapons would make the United States appear to be a warmongering nation bent upon a world arms race. Then, in the fall of 1949, Russia's first atomic explosion made us realize that an arms race was no longer a possibility to be avoided but a frightening reality to be faced.

At Los Alamos, the feeling was widespread that this was the time to pursue development of the hydrogen bomb. A few months before the Russian explosion, I had returned to Los Alamos on a year's leave of absence from the University of Chicago. I felt that the Russians would follow their development of a fission bomb with a success in fusion. In that case, the Soviet Union would be far ahead of the United States in the field of nuclear weapons. When Los Alamos was established in 1943, it was understood that

thermonuclear possibilities were to be thoroughly explored. After Russia's first atomic explosion, most of us at Los Alamos felt that the time finally had arrived.

Our enthusiasm was not shared by the powerful General Advisory Committee of the Atomic Energy Commission, headed by Oppenheimer. This committee often had a determining voice in AEC policies. On October 29, 1949, a month after President Truman's announcement that Russia had achieved an atomic explosion, the General Advisory Committee met in Washington to give the AEC an opinion on the advisability of undertaking development of a thermonuclear bomb. Committee members, after a round-table discussion of the problem, voted unanimously against any H-bomb program. The unanimous report included this statement: "We all hope that by one means or another, the development of these weapons can be avoided. We are all reluctant to see the United States take the initiative in precipitating this development. We are all agreed that it would be wrong at the present moment to commit ourselves to an all-out effort towards its development."

The GAC report carried two supplementary statements that became known as the majority and minority reports, although the controlling recommendation was unanimous. The majority report was signed by Oppenheimer, James B. Conant, Lee DuBridge, Hartley Rowe, Cyril Smith and Oliver E. Buckley. In its final paragraph, the majority report said: "In determining not to proceed to develop the Super bomb, we see a unique opportunity of providing by example some limitations on the totality of war and thus eliminating the fear and arousing the hopes of mankind." The minority report, signed by Fermi and I. I. Rabi, held: "The fact that no limits exist to the destructiveness of this weapon makes its very existence and the knowledge of its construction a danger to humanity as a whole. It is necessarily an evil thing considered in any light. For these reasons, we believe it important for the President of the United States to tell the American public and the world that we think it is wrong on fundamental

ethical principles to initiate the development of such a weapon.”

The negative recommendation of the General Advisory Committee was not communicated immediately to Los Alamos. An effort was made to keep congressional leaders from knowing that scientists close to the problem might disagree with the GAC report.

A few days after the GAC meeting, I was on my way from Los Alamos to Washington to keep an appointment with Senator Brien McMahon, chairman of the Joint Congressional Committee for Atomic Energy. I stopped to see Fermi in Chicago. Despite our very close personal relationship and his knowledge of my almost desperate interest in the thermonuclear effort, he insisted that he could not even give me an indication of the GAC decision. But it was clear from the tenor of his remarks that certainly Fermi and possibly the entire GAC did not favor an all-out crash program. While I was in Fermi's office, I received a telephone call from John Manley, secretary of the General Advisory Committee who also was associate director of Los Alamos. Manley asked me not to see Senator McMahon. I asked why I should not. He replied that it would be unfortunate if congressional leaders thought that scientists had a divided opinion on the thermonuclear question. I told Manley that I had an appointment with Senator McMahon and intended to see him. Manley insisted that I should not. I offered to telephone Senator McMahon and tell him that I was canceling my trip to Washington because I had been asked not to see him. Then Manley gave up, saying: “All right. You better go and see him.”

I still did not know the contents of the GAC report when I saw Senator McMahon, and he did not reveal them to me. He did, however, use strong words in reference to the report even before I had an opportunity to ask about it. He said: “I read this report, and it just makes me sick.” Still a little mystified about the actual recommendation of the GAC, I told Senator McMahon that I considered it vital to the nation's defense that we proceed with the thermonuclear work. He assured me that he would do

everything in his power to make the thermonuclear bomb a reality.

Almost two weeks passed before I had certain knowledge of the GAC recommendation. Manley, back in Los Alamos, asked me into his office and showed me both the minority and majority reports. I could see little difference between them, and I was certain that the thermonuclear effort had been effectively killed.

I was, however, completely mistaken. The report produced precisely the opposite effect among the Los Alamos scientists. Immediately, of course, the GAC report did stop work on the thermonuclear bomb, because it was tantamount to an explicit instruction to that effect. After a few days, however, the implications of the report began to sink in. It seemed to restrict the Los Alamos scientists to minor improvements in the old field of fission. But many of the scientists, especially the younger men, found it difficult to control an adventurous spirit urging them to get into the newer field of thermonuclear reactions. The GAC report seemed to state the conflict rather bluntly: As long as you people work very hard and diligently to make a better atomic bomb, you are doing a fine job; but if you succeed in making real progress toward another kind of nuclear explosion, you are doing something immoral. To this, the scientists reacted psychologically. They got mad. And their attention was turned toward the thermonuclear bomb, not away from it.

This psychological reaction to the GAC report, this scientific anger, certainly could not have produced a hydrogen bomb by itself alone. Solution of the theoretical and engineering problems involved in the thermonuclear program required an intensive effort, a concerted action impossible to achieve in a laboratory instructed not to work on the problem. Without a clear go-ahead, Los Alamos could not have produced a hydrogen bomb. Empty anger was not enough. A decision was needed. And President Truman was urged to make that decision by AEC Commissioner Strauss, Senator McMahon, and other members of the Joint Congressional Committee for Atomic Energy.

Ironically the man who gave our atomic secrets to Russia also had an important influence on the decision to proceed with the hydrogen bomb. Klaus Fuchs, who was at Los Alamos when we reviewed all we knew about thermonuclear reactions after Hiroshima, confessed in late January 1950 that he had passed secrets to Communist agents. Four days after Fuchs' confession, President Truman overrode the recommendation of the GAC and directed the Atomic Energy Commission to go ahead with the hydrogen bomb.

The presidential directive was not a complete surprise to me. A few days before President Truman's decision was announced, I met Oppenheimer at a conference on atomic energy. He made it clear that a top-level decision was being made, and that it probably would direct development of a hydrogen bomb. Recalling his effective leadership of the laboratory during the war, I asked Oppenheimer whether he would really go to work on the hydrogen bomb if President Truman did authorize an all-out thermonuclear program. His reply was negative.

Although I was prepared for the presidential decision of January 29, 1950, I was not prepared for the language of the decision. President Truman directed the AEC to *continue* its thermonuclear program, giving the impression that we could produce a hydrogen bomb simply by tightening a few last screws. People understood from his announcement that the job was almost done. Actually, work had not begun. We had eight years of thermonuclear fantasies, theories, and calculations behind us; but we had established no connection between theory and reality. We needed a thermonuclear test.

I still was associated with the Los Alamos Scientific Laboratory when President Truman announced his decision. But, distressed by the opposition of the GAC, I had accepted an appointment as professor of physics at the University of California in Los Angeles and planned to begin teaching in the fall of 1950.

The theoretical supervision of all our projects became Mills' responsibility. Taking his cue from the sad post-mortem sessions that had followed our early failures, Mills launched the exceedingly useful pre-mortem discussions that preceded our later successes. Before any new device was tested, it was reviewed and discussed by some of our experienced scientists who had nothing to do with its development. Mills' pre-mortem discussions of each new device provided valuable independent criticism while welding the laboratory into a single, purposeful unit. The pre-mortem sessions helped us to avoid becoming a collection of specialists who had only a nodding acquaintance with each other's difficulties and accomplishments.

Even while the Livermore Laboratory was making rapid and valuable progress in weapons development, Ernest Lawrence was participating in a serious and determined attempt to ease cold-war tensions by finding a way toward effective and verifiable disarmament. Harold Stassen, leader of the Eisenhower administration's disarmament effort, organized an advisory group of experts. As a member of this group, Lawrence was responsible for all aspects of disarmament connected with nuclear energy. He asked several of us at Livermore to help him in this work. Foremost in our group was Mark Mills.

These disarmament efforts, like all others, eventually were blocked by the stone wall of Communist intransigence. But during the discussions we did make a simple and practical proposal: Nuclear arms are small, powerful, relatively inexpensive, and easily hidden. Disarmament, therefore, should not begin with nuclear disarmament. The first steps toward disarmament, instead, should be taken in fields where the cost of weapons is higher and where armament is more conspicuous and more easily checked. Only after international tensions are relaxed and mutual confidence established by measures of conventional disarmament

should we tackle the infinitely more difficult task of nuclear disarmament.

In the meantime, we thought an important concession could be made to public opinion. The dangers of radioactive fallout in the atmosphere had been exaggerated out of all proportion. Millions of people were worried about fallout. Although the danger was purely imaginary, the worries were real. We proposed that the amount of radioactivity released into the atmosphere should be limited to a small amount that could be proved harmless in a completely convincing way. This simple and moderate proposal, unfortunately, was neither pressed upon the Administration nor explained to the public.

As the fear of fallout mounted, the clamor increased in this country for a halt of all nuclear tests. The emotional appeal of such a radical demand was all too clear: The root of all the fears, troubles, and anxieties of the atomic age was the atomic bomb. Stop development of such monstrous weapons, and all the world's difficulties will vanish. Let us set the clock back beyond Hiroshima. Or, if we can't do that, let us at least stop the clock now.

Clocks can be turned back or stopped, but time cannot. I felt that we could not stop progress, that advances certainly would be made in the nuclear field by Russia if not by the United States.

Early in the summer of 1957, Lewis Strauss took Ernest Lawrence, Mark Mills, and me to see President Eisenhower. We described to the President some of the probable future developments in the field of nuclear explosives. One point was raised in the discussion which was and still is of great importance: We can perfect "clean" nuclear explosives. These can be used in war to destroy an intended target without releasing radioactivity to be carried by the winds to do damage indiscriminately where no damage was intended. These "clean" explosives can also be used in peace as a powerful workhorse in mammoth construction jobs.

President Eisenhower listened to our arguments. And, for the time being, we obtained permission to proceed with our work.

Most people responded to such ideas with a shrug and with an incredulous smile. But, after a short time, many of us at the Livermore Laboratory were convinced that nuclear explosions could be thoroughly useful.

During the same summer, Brown mentioned the idea to Dr. I. I. Rabi, a famous physicist with a quick wit. Rabi responded to Brown's enthusiasm with a dry remark: "So you want to beat your old atomic bombs into plowshares."

Brown had no reply, but he now had a name for his special interest: Project Plowshare.

Fortunately, there was an early opportunity to get started with Plowshare. David Griggs, who had effectively aided establishment of a second weapons laboratory, suggested in 1956 that we explore the effects of an explosion deep underground. Griggs, by profession, was concerned with the physics of the earth, and thought that an underground explosion might produce information about the processes occurring in the earth's crust. He pointed out that all the radioactivity produced by an underground explosion would be imprisoned. Necessary safety measures could be simplified, and we no longer would need to mobilize an army of meteorologists to predict wind directions for a test. We could gain flexibility by preparing appropriate locations for underground testing, and we then could proceed with a nuclear experiment whenever we were ready.

Gerald Johnson, who was in charge of Livermore's nuclear tests, recognized these advantages. He also realized that an underground experiment could have an important bearing on our plans for Project Plowshare. The experiment was scheduled for September 1957.

An explosive equivalent to 1700 tons of TNT was placed in a mesa in the Nevada desert. From an observation post a few miles away, a small group from Livermore watched the explosion. They saw much less than they would have seen in an atmospheric test.

The mesa shivered and appeared to lighten in color. The top

of it jumped upward nine inches, throwing up some sand that cascaded down the slopes. Then the earth fell back into place, apparently unchanged except for a few fissures. A slight shock was felt at the observation post. No trace of radioactivity escaped. The experiment was complete.

Then the real work started. The Livermore team had to discover what had happened inside the mountain. The radioactive deposit had to be found. It took weeks to locate the radioactivity, months to piece together details of the underground drama.

The explosion, 797 feet from the mesa's nearest surface and 900 feet from its top, vaporized rock to blow a hole 110 feet in diameter. This hole was lined with four inches of molten rock which contained much of the radioactivity produced by the explosion. Icicles of rock formed in this molten layer and dripped. Then the entire cavity collapsed. Forming a cup beneath the point of explosion, the molten layer congealed into a glassy substance imprisoning much of the radioactivity in an all but insoluble form.

The porous, water-saturated rock around the original hollow sphere was crushed and lost much of its water. When the hollow sphere collapsed, a chimney of rubble 400 feet high and weighing more than 100,000 tons was formed above it. Unlike nearby material, the rubble in this chimney was water-permeable. Some radioactivity had escaped into it. All this radioactivity was watched for years. It moved inches, feet. Long before it could reach any living thing, it would decay. After more than a year the loose material in the chimney again solidified, and it no longer was permeable to water.

All this was highly interesting, and it was most important to Project Plowshare. Our experiment had confirmed that we could break up large quantities of rock and make it permeable to water. And other nuclear explosions had taught us that we could greatly reduce the total radioactive output of a bomb. In time, we could make our Plowshare tools "clean."

Sputnik caused fear. It was painfully apparent that Russia, capable of throwing a satellite around the earth, also could launch a device armed with an atomic bomb or a hydrogen bomb. Watching Sputnik flash overhead in the night, Americans realized as never before that our nation was in the range of Russian rockets—rockets that could carry the terrible destructiveness of nuclear weapons from launching pad to target, from continent to continent, from hemisphere to hemisphere in twenty minutes.

Sputnik shrank the world and canceled the guarantee of safe isolation that had been provided us by the great oceans. Sputnik made it obvious and essential that we revise our preparations for national security, overhaul our plans for civilian defense, abandon concepts that suddenly were obsolete, and concentrate on a new kind of technological exploration.

In the range of Russian rockets, we could not hope to evacuate our cities and prime target areas in case of attack. Our fighter planes, designed to meet approaching bombers, could not be used to protect us against missiles. Wartime attack by long marches of weary men had been a matter of months. Bombing tactics perfected during World War II made conflict a matter of hours. Sputnik made destruction a matter of minutes.

The Russian achievement was a surprise. Actually, it should have been expected. Long before Sputnik, we had persistent reports and published evidence of a great Soviet effort in space technology. In Geneva during the 1955 Conference on the Peaceful Uses of Atomic Energy, our scientists were impressed by Russian interest and achievements in space projects. Our military experts were aware that Russian rocketry had played a great part in repulsing German forces at Stalingrad, and we were equally aware that after World War II some of the most accomplished German rocket technicians and space scientists had disappeared behind the Iron Curtain.

Russia had good reason to be interested in rocket development,

meda without having his life span prolonged almost indefinitely.

Scientists and engineers working very hard for a few hundred years could conceivably develop a vehicle and a means of propulsion that would allow man to go almost as fast as light. Suppose we put an astronaut in this vehicle and shoot him off toward Andromeda. The time required for him to get there would be relative; it would have one duration for him and a different duration for the people he left behind on the earth. This difference, to a space traveler, would be most important. And it can be determined in advance.

Einstein showed that although the time difference does not remain the same for all observers—and this is a most surprising but true statement—another quantity does remain the same for all. This quantity can be called Q , and it can be calculated with the help of a simple formula. Take the distance (ct) that light moving with the speed c could have covered during the observed time difference t between take-off and landing; multiply this length by itself, giving $(ct)^2$. Then take the distance between take-off and landing, call it R , and multiply that by itself, giving R^2 . Subtract one from the other for the quantity: $Q = (ct)^2 - R^2$.

This Q remains the same for all observers, and this proven rule of Einstein's is important.

Observers on the earth would see the rocket heading toward Andromeda almost as fast as light. The rocket would appear to take just a little more time than light would have taken to reach the distant galaxy—slightly more than two million years. The distance actually traveled between the earth and Andromeda would be, let us say, precisely two million light-years. So the difference— Q —between the two huge quantities— $(ct)^2$ and R^2 —would seem quite small to people on the earth, since the astronaut's rocket traveled the distance almost as fast as light.

The difference— Q —will be the same for the astronaut. But he will have to use different figures in the rest of his formula. His world will be his rocket. In this world he will remain stationary.

He will depart from the earth and arrive at Andromeda in the same position: at the controls of his spaceship. He will have to say that he did not move, but that the universe moved past him. He must say, therefore, that the distance he actually covered between his departure and arrival— R —is zero. This will be fully valid and justified, and this is an important point in Einstein's work. The astronaut will feel the same as you feel on our whirling planet: The sun rises and sets and the universe moves around you, but if you are sitting still you do not move.

The difference— Q —must be the same for the astronaut as for the earth-bound observers. Since Q appeared small for the people on the earth, Q also must be small for the astronaut. But since the distance covered by the astronaut between take-off and landing— R —seems to him to be zero, the time required for the flight will seem much shorter to him than to people on the earth.

To the astronaut, the rocket flight from the earth to Andromeda might seem to have taken perhaps only twenty years. To observers on the earth, the same flight will seem to have taken a little more than two million years.

Suppose the astronaut spent ten years exploring the galaxy of Andromeda and then returned to the earth. He would expect a hero's welcome, a ticker-tape reception in New York, and a high decoration from Congress. Far from it. He would be only fifty years older than when he began his historic flight, but the earth would have aged more than four million years. All his friends and relatives would be dead. No one would speak his language. He would find the world inhabited by a strange race that he would consider horribly deformed, but which in reality would be far superior to his own both in understanding and in intelligence. They would undertake the scholarly task of deciphering his notes. And when his wild tale of a space flight begun four million years before had been confirmed by archaeological investigations, this new arrival, this astronaut, this specimen of an ancient and extinct race would be put in a zoo.

exceedingly small. The bones of humans throughout the world today are getting an average of about 0.002 roentgens a year from Strontium 90 in the fallout. The rest of the body is being exposed to about the same amount of radioactivity, mostly from the fallout's Cesium 137. In certain areas there is a greater accumulation of fallout, but it would be difficult to imagine that anyone in the world could receive a lifetime dose of more than four or five roentgens of radiation from fallout. This still is less than radiation received from cosmic rays alone.

We found it enlightening to compare the human exposure to radioactive fallout with the human exposure to natural background radiation. The same doses of radiation from fallout's Strontium 90 and from cosmic rays will produce similar effects in human bones. People living at sea level in the United States are exposed to 0.034 roentgens of radiation from cosmic rays each year. This is seventeen times the amount obtained from the Strontium 90 in the world-wide fallout. Exposure to cosmic rays in Denver, about 5000 feet above sea level, is 0.05 roentgens a year. If such small doses of radiation really were dangerous, we had better evacuate Denver.

Radiation from radium is somewhat more dangerous to the human body than radiation from Strontium 90. But while world-wide fallout radiation to the bones from Strontium 90 continues at a dose of about 0.002 roentgens a year, radiation from radium in the drinking water in some parts of the United States has been observed as high as 0.005 roentgens a year. If such small amounts of fallout radiation really are dangerous, people in some United States communities should stop drinking their local water.

Brick contains more natural radioactivity than wood. A person living in a brick house rather than a wooden house is exposing himself to a considerably greater amount of radiation—perhaps as much as ten times the amount of the current dose from radioactive fallout. If fallout really is dangerous, we should tear down all of our brick houses. I would hate to do this, because I live in a brick house myself.

The comparisons are almost endless. A person wearing a wrist watch with a luminous dial is exposing himself to much more radiation than he is getting from the present level of radioactive fallout. If we really fear fallout, we should throw away bedside alarm clocks with dials that can be seen in the night because they are spraying the occupants of the bed with radiation.

If we had used natural background radiation as the standard in judging the danger of exposure to artificial radioactivity, the fallout scare might never have developed. Unfortunately, this was not done. Instead, arbitrary standards were decreed, and to make them safe they were set at a rather low level.

Radiologists in the early 1940s, taking their cue from the hard experiences of medical pioneers, considered one tenth of a roentgen-unit a day as the dose which for safety's sake should not be exceeded in steady practice. This was based upon observation. No statistical evidence could be found that a steady exposure to one tenth of a roentgen a day produced any harmful effects. This old standard of safety permits exposure to 10,000 times as much radiation as the average person now receives from world-wide fallout.

This medical standard at first was adopted in our work on atomic energy. I remember the first information I was given when I joined the atomic energy project in Chicago in 1942: "You must never exceed an exposure of one-tenth of a roentgen-unit a day. As long as you observe this rule, you are safe." As a theorist, I had little occasion to be exposed to radiation. But the general enforcement of radiation standards paid off in our atomic energy projects. We had no sad experiences comparable to those of the early medical pioneers.

Serious arguments later arose about possible long-range dangers of radiation exposure. The dosage accepted as safe, accordingly, was decreased to three tenths of a roentgen-unit per week. This standard still is several thousand times higher than the ex-

posure to world-wide fallout. No harmful effects were observed, and this standard generally continues to be enforced in our laboratories.

But a question was raised: "When we consider whole populations rather than small numbers of professionals, should we not apply more cautious standards?"

The question appeared reasonable enough. It was decided that for whole populations only one tenth as much radiation should be tolerated as for small professional groups. This decision was completely arbitrary. It was based on no observed fact or general argument. It was guided by a desire to be absolutely safe even though we were virtually certain that these faint radiations were not dangerous. The authorities in subsequent years, trying to make safety multiply safety, further decreased this so-called "maximum permissible dose."

This designation, "maximum permissible dose," was most unfortunate. It suggested that anyone receiving more than this dose was in trouble. When, due to a local fluctuation, a small group of people received a sizable percentage of this "maximum" dose, there were feelings of alarm. When the "maximum" standard was lowered, there were feelings of uncertainty and distrust. Thus public confidence was lost, and exposure to small doses of radiation was firmly established as dangerous in the popular opinion.

The fact is that the "maximum permissible dose" is approximately four times the background radiation to which all living things have been exposed for all time. An exposure to ten times the "maximum permissible dose" certainly can be tolerated.

I do not propose that we relax our vigilance in guarding against possible dangers of radiation. But I do propose that the man-made and arbitrary "maximum permissible dose" should not be used as a measure or standard of danger. We should, instead, compare all exposures to the average background radiation. This radiation is a fact of nature. There can be little disagreement about its magnitude or its significance.

Probably there is no major United States scientific advance of which the Russians are ignorant. Still, the United States persists in spending millions of dollars a year to maintain a rigid scientific-technological secrecy.

The cost of maintaining secrecy in this country is high because the amount of secrecy is large. I cannot say just how many secrets the United States is trying to keep. Even that is secret.

Our concern, however, is not the amount of secrecy or even the cost of secrecy, but the fact of secrecy and the effects of secrecy.

The effect of secrecy upon our scientific development is ironic. Because we try to keep a potential enemy from knowing what we know, we know less ourselves. In a free country like the United States, people do not like to work in secret. By its very nature, secrecy involves rules and regulations that impinge upon freedom. Scientists, like anyone else, dislike regulations and restrictions. So scientists prefer to work in areas free of secrecy, where the interchange of ideas is encouraged and where they can become known for their achievements. By repelling some of our best minds from work that is badly needed for our defense, secrecy has performed a disservice to our nation.

Russian secrecy does not have the same effect upon Russian scientists. Secrecy was firmly established under the czars as well as under the Communists in Russia. Scientists working outside nuclear projects are just as restricted and as regimented as those who are engaged in these high-priority efforts. So Russian scientists are not tempted to abandon military efforts for the sake of personal freedom, because personal freedom simply does not exist.

Since the United States no longer has a nuclear monopoly, our safety no longer lies in keeping all we know to ourselves. Rather, our safety depends upon the rapid conception and utilization of ideas. The United States and Russia today are competitors in several races: The race in atomic energy, the race for space, a

race for men's minds, a race to influence uncommitted nations, a race for national defense and survival. These are races of ideas, contests of the mind, and the winner of each race will be the nation which is the fastest producer of the best ideas. Because free discussion encourages progress and usually improves ideas, I believe less secrecy would mean more speed in our race for new and useful ideas. And the United States needs more speed in the races which vitally concern our freedom and survival.

Exaggerated nuclear secrecy not only slows our scientific development, but it also stands as a barrier between ourselves and our allies. Secrecy has forced the United States to assume the ridiculous posture of denying to our friends facts that are known to our enemies.

The United States has taken several significant steps to reduce nuclear secrecy, especially between ourselves and our allies. We published the relevant principles of reactor construction in the Smyth Report as early as 1945, and we took the initiative in revealing essential methods of reactor technology at the 1955 Conference on the Peaceful Uses of Atomic Energy in Geneva. The Atomic Energy Act was liberalized in 1958 to allow even more discussion of nuclear secrets with our allies. All this has helped alleviate the problem of nuclear secrecy but has not eliminated it. The barrier of secrecy still stands between ourselves and our friends, resulting in a duplication of effort, a waste of time, and a waste of money.

Our policy of continued secrecy, for example, forced the French to make an independent effort to explode atomic bombs. Surely it would have been wiser for the United States to have shared nuclear secrets with the French and freed France's scientists from the time-consuming rediscovery of facts and methods already known to us. The cause of freedom would have been advanced if our nuclear secrets had been used to unite rather than divide, if the considerable talents of French

scientists had been utilized in a common undertaking aimed at increasing Western security rather than devoted to the rediscovery of known facts.

The disservice performed by secrecy in erecting artificial barriers between friends cannot be overestimated. We live in a time that demands common action among the free nations in the building of a lawful world community. It is self-defeating to permit nuclear secrecy between friendly nations to hamper co-operation.

Aside from creating a moral disunity among free nations and suggesting that the United States really does not trust its allies, our continuing policies of nuclear secrecy seriously weaken the West's defense against World Communism. We have convinced ourselves that we should not discuss all of our nuclear weapons even with our allies. The United States has weapons in its arsenal and on its drawing boards that have never been disclosed to friendly nations bound to us by treaties of mutual defense. Since secrecy is contagious, it is not inconceivable that these same nations may have developed some weapons that have never been discussed with us. I think we cannot expect the North Atlantic Treaty Organization countries to develop the best plan of mutual defense when the instruments of defense are not fully known to all NATO countries.

It is not enough to give our NATO allies some of the nuclear weapons we have developed and constructed. We also should discuss with them our future plans. Adaptation of a military organization to advances in weaponry often requires more time than development of the weapons themselves. If NATO nations are kept ignorant of advances in nuclear weapons, if they cannot plan ahead, NATO's military organization cannot be expected to make effective use of new weapons when they are developed. Our NATO defense cannot realize its full potential as long as we keep our nuclear plans and nuclear secrets to ourselves.

Free and open discussion of our nuclear work would cer-

tainly strengthen both the military defense and the political unity of the free world. To the extent that our secrecy isolates free nations from one another and creates suspicions between allies, it certainly performs a disservice.

Secrecy's most insidious danger, however, is to our own form of democracy. A bulwark of our system of government is the people's right to know. Secrecy, in effect, denies that right.

We have instituted safeguards which, to some extent, will prevent the subversion of democracy by our policies of secrecy. We have made our nuclear effort the responsibility of a civilian rather than a military agency. And the Atomic Energy Act recognized the danger of entrusting our atomic program to any single agency, civilian or military, functioning in complete secrecy. To avoid the dangers of centralized, secret power, the Joint Congressional Committee for Atomic Energy was established. This committee balances the power of the Atomic Energy Commission by making critical reviews of all important decisions. The committee and its staff—none of them scientists—have done a remarkable job of understanding, appreciating, and criticizing the complex field of nuclear technology. The committee and the commission constitute a team that often has been harmonious and almost always has been effective. Members of the congressional committee are empowered to penetrate the aura of secrecy that surrounds all nuclear matters and judge nuclear decisions and progress as representatives of the people.

But public representation, in this case, is not the same as public participation. Neither is it as effective. No matter how well the public's elected representatives perform their duties as nuclear watchdogs, a better system of checks and balances would be provided by an informed public opinion. The government often cannot act effectively without public support. It frequently cannot act wisely unless the public is informed. It must act either

arbitrarily or unwisely if the public is misinformed. And secrecy breeds misinformation.

Misinformation has indeed flourished and multiplied in the postwar years. Secrecy is not entirely to blame. The American public has assumed that questions of nuclear energy and nuclear explosives are beyond the understanding and judgment of the average individual. Most people believe that these difficult questions should be left to the expert.

Besides, these problems are not merely difficult. They also are disagreeable. They force one to think of war, of nuclear conflict, of Hiroshima, of things that would be more comfortably forgotten. Better leave all these questions to the expert.

I cannot escape the suspicion that this public attitude is somewhat analogous to the behavior of an individual who has a disturbing problem. It is not unusual for such people simply to ignore their problem; the disturbing fact is shoved aside, forgotten. Psychologists have an expression for this phenomenon: Repression. And repression is not a sign of mental health.

Analogies are incomplete and even dangerous. But it seems to me that secrecy has become a psychological defense mechanism for a considerable segment of the American people. Secrecy is the vehicle of repression. It helps to make it possible and even necessary to forget what most people prefer not to remember.

Thus a great burden of responsibility was offered to the expert scientists, to a group which happened to live outside the main stream of American life. The responsibility was greater than that carried by any other group of citizens—with the single exception of the elected representatives of the people. And what did the experts do with the considerable share of responsibility that was thrust upon them? They did what most people would have done in similar circumstances. Many of the experts gladly accepted these responsibilities. They felt that scientists, the most intelligent of all citizens, had been entrusted with their due, the responsibility for important decisions that they could handle more capably than anyone else.

These attitudes and consequences have created a situation in which the common people, the sovereigns of our democracy, have abdicated. The right to know is a basic institution of our democracy. More than that, it is an obligation of every citizen. As long as governmental secrecy denies that right, as long as secrecy spawns a public indifference to that right, as long as most of our citizens ignore the obligation to know and leave vital decisions to be made by an elite of "experts," our secrecy is a threat to our democracy.

In addition to the experts, another, incompletely informed group participates in the molding of American public opinion. This group includes newspaper and magazine editors, reporters, commentators, columnists, clergymen, teachers, authors, government officials—almost anyone who has an audience and who has something to say. These opinion makers have continued to shape the public mind despite our government's official policy of nuclear secrecy, despite their exclusion by secrecy from knowledge of vital decisions and developments, despite the obvious limitations imposed by secrecy upon intelligent discussion. The result has been a misinformed public opinion still exerting its traditional influence on the formation of important national policies. This has been dangerous and could be disastrous.

Several recent examples can be cited of public opinions that were uninformed or misinformed and so led to trouble. The AEC, in its constant review of secret material, had declassified all of the facts about radioactive fallout before Democratic candidates made this topic the issue in a public debate during the 1956 presidential campaign. But because the facts once had been secret, the suspicion persisted that perhaps the government had not told all that was known about fallout dangers. This suspicion paved the way for the excited and unsupported predictions of some scientists that fallout could kill thousands of the living and make future generations grotesque. The result was a national bath in the emotion of fear that became known as the

fallout scare, and a misinformed public opinion demanded that we halt nuclear tests.

Another example arose during the Geneva negotiations on test cessation. In the early months of 1959, we proved that underground nuclear explosions could be muffled and hidden from detection. But this knowledge was withheld from the American people, and the public opinion was allowed to form that violations of a test ban treaty could be detected and identified anywhere in the world. The detection difficulties were revealed to the American people by our government only after they had been discussed with Russia. And, by then, it was almost impossible to focus public interest on the technical difficulties and change the established and prevailing public opinion that, in safety, we could agree to ban all nuclear explosions. Our people could not have been misled and the public opinion would not have been wrong if all the facts had been available to all the people all the time.

Even today, a sound and rational public opinion on the need for certain nuclear weapons is greatly impeded by secrecy. And because the public cannot be fully informed of the need, public opinion cannot be aroused to the point of demanding the weapons. There is an urgent need for better tactical nuclear weapons. These weapons, I believe, must be developed as the tools of limited nuclear warfare. Beyond this, I can say little. Because of secrecy, I cannot be explicit. I suspect that Russian leaders know more about our nuclear weapons plans than do the American people. Our own policy of secrecy allows only a superficial description of our weapons needs for the benefit of our own people. Secrecy makes it difficult to awaken Americans to the real dangers and real opportunities of our atomic age.

There are two popular and powerful arguments for continuing nuclear secrecy.

One argument is that if we did not keep our nuclear secrets,

more and more nations would produce nuclear weapons. This argument once had merit; today it has little. We could find assurance in our nuclear secrets only as long as we had a nuclear monopoly. But that monopoly has been broken, and every nation with the materials necessary for a nuclear explosive has succeeded in making a bomb. Production of the explosive materials is somewhat difficult, but they can be produced in any nuclear reactor. Since the United States published reactor principles in 1945 and revealed essential portions of reactor technology in 1955, there is little reason to believe that even a small nation willing to spend the time and money would be unable to put together a nuclear bomb. The number of nations winning membership in the group known as the Nuclear Club certainly will increase. Despite our zealous secrecy, more and more countries will achieve a nuclear capability. This is inevitable. We should realize now that when this inevitable development occurs, when additional nations that are both friendly and unfriendly succeed in constructing nuclear weapons and the means for their delivery, our policy of secrecy then might perform its greatest disservice. If we persist in nuclear secrecy, the nuclear capabilities of additional countries will certainly be developed in secret. This could lead to a tragic and perhaps fatal misjudgment on the part of the United States. Suppose a small but ambitious nation developed just one atomic bomb in secret and fired it upon a target in the United States. We would retaliate, but most likely against an innocent party, and the misjudgment prompted by secrecy could plunge the known nuclear powers into an all-out war. World-wide openness would greatly decrease the possibility of such a tragic error.

The other argument for continuing secrecy is more valid: If we tell the world our nuclear secrets and the Russians keep theirs, it is obvious that Russia always will be ahead of us.

This is a serious argument. If we abandoned scientific secrecy completely and Russia did not, the Soviet Union surely would have some advantage. But the degree of that advantage is ques-

tionable. It certainly would be a short-term advantage. Nations at about the same stage of technical development usually discover the same technical facts at about the same time. General scientific principles can be kept secret for only a very short time, because secrecy of itself does not prevent the spread of ideas or their rediscovery by scientists of other nations. When two or more parties have reached about the same level of development, scientific secrets remain secrets for only a couple of years.

This, then, is our dilemma: If we should abandon nuclear secrecy, we would give the Communists some advantage. If we retain secrecy in its present form, we slow our nuclear progress, erect a barrier between ourselves and our allies, force a deplorable duplication of time and effort upon the building of a common Western defense, and impede the formation of a well-founded American public opinion. There is no question, in my mind, that secrecy's service in giving us some scientific advantage is transient and limited. Secrecy's disservices, on the other hand, seem to me to be cumulative and substantial.

Important steps have been taken toward elimination of secrecy. But more should be done. At the very least it is necessary to apply our rules of secrecy in a more liberal manner. A more radical and persuasive suggestion has been made by Niels Bohr, a man who has always opposed secrecy in scientific matters.

Shortly after the end of World War II, Bohr suggested that scientific openness would be to the advantage of the democratic countries. In the hands of a dictator, secrecy can be an effective weapon. In a democracy, the weapon will backfire. Our natural weapon is openness. It may not seem completely obvious that openness can be used to fight dictatorships. But openness will make it easier to unite the free world in the interests of safety and progress. And openness may, in the course of decades, penetrate the Iron Curtain and help us defeat the spirit of the police state.

But that the wholesale bombing of Russia is a greater evil than limited Soviet aggression can hardly be denied.

In a dangerous world we must be prepared for all eventualities. To build a nuclear strategic air force was a necessity. Not to develop a more moderate response to limited aggression was a mistake. To believe that atomic bombs are absolute weapons to be used only as instruments of wholesale slaughter is dangerous confusion. That this confusion should have been firmly established in so many minds was one of the consequences of Hiroshima.

The United States, confident that Russia could not produce an atomic bomb until around 1970, probably would have continued its headlong plunge toward unpreparedness had it not been for the foresight of Lewis Strauss. Months before the explosion of Russia's first atomic bomb in 1949, Strauss persuaded the government to establish regular flights of patrol planes equipped with special filters that would pick up radioactive particles from the atmosphere. Knowing the rate of radioactive decomposition of these particles, we could date their creation back to one of our atomic test explosions. In September 1949 particles were collected that could not be dated back to one of our explosions. We knew, then, that Russia had the bomb.

President Truman told the nation on September 23, 1949, about Russia's unexpected accomplishment. In the next morning's newspaper, I saw a headline: **THE UNITED STATES WILL HOLD ITS ADVANTAGE.** A single Russian bomb, of course, could not wipe out our advantage. But it had been predicted that Russia would not have the bomb for many years. We had been overconfident. I wondered whether, in the face of the Soviet success, we would continue in our overconfidence.

Worried and anxious, I telephoned Oppenheimer. I had been asked to give him a message during a trip to England from which I had just returned. But the real reason for my telephon-

ing to use them—appeared logical. On September 23, 1949, the day we learned that Russia also had an atomic bomb, the concept of massive retaliation was on its way to becoming illogical nonsense. On that day we had to recognize that if we bombed Russia, we would be bombed ourselves.

As Russia advanced in the fields of nuclear weapons, airplanes, and rocketry, massive retaliation was checkmated. The United States obviously would never punish Russia for launching a small-scale invasion if our massive retaliation would provoke a nuclear attack upon us.

We were at a standoff. The diplomats called it “mutual deterrence.”

In an important respect, mutual deterrence is as impractical as massive retaliation. Neither concept is workable because each pretends to draw lines where no lines can be drawn—between war and peace, between aggression and defense, between significant and insignificant acts. Each leaves us unprepared for the ambiguous acts of the Soviet government: Acts which lead to extension of Communist power, but which nevertheless are not clear-cut acts of aggression.

In the long run, mutual deterrence will fail because the policy does not consider the very different aims of the United States and the Soviet Union. Nor does it consider the methods traditionally employed by each country to achieve those aims.

The Communists have a clearly understood, openly announced, and firmly held revolutionary aim: World domination. They pursue this aim with deep conviction, with impressive zeal, with religious fervor. They have imposed great sacrifices upon the Russian people in the interest of their long-range plan to dominate the world. But that plan tells them not to take extreme chances. Russia does not enter situations which do not hold out a great probability for Russian victory. Communists move when the odds are with them. They have a word for taking unnecessary chances. It is called “adventurism,” and this is one of the most serious errors a Communist can make. Soviet leaders, unwilling to take

be foolhardy for the United States to conduct its military planning as if nuclear weapons did not exist.

These four points, to be discussed in following chapters, are necessary for a strong United States position in the nuclear age:

1. We must have an adequate passive defense. We must anticipate nuclear attack and be prepared to survive it. A nuclear attack on the United States would be horrible beyond imagination, but we must imagine it. We must, in fact, plan against it. An unprepared nation invites attack. We must, therefore, prepare for an attack. Properly prepared, we can survive a nuclear attack.

2. Having survived an attack launched against us, we must be able to strike the second blow. The United States has started to build up a second-strike force, a strong nuclear force capable of immediately returning any attack made upon our nation. This would not be massive retaliation, which calls upon the United States to return any attack made upon any ally. Our second-strike force would be mounted to return an all-out assault only if our own nation or territories that share our loyalties and institutions were attacked. In making certain that we could absorb and return an all-out nuclear attack, we would attain a major but limited objective: Our survival as an organized society with an organized industrial complex and an advancing civilization. If we were properly prepared, Russia, of course, would know that we could survive an attack made directly upon our nation and would know we were capable of counterattack. The Soviet Union, knowing these things, would never attack the United States directly.

3. We must prepare for limited warfare—limited in scope, limited in area, limited in objectives, but not limited in weapons. A localized, limited nuclear war will be the answer whenever the Russian method of ambiguous aggression degenerates to an outright attack against our allies. It will be the alternative to a disastrous, all-out, world-wide nuclear war. To prepare for a limited war, we must develop new kinds of international di-

CHAPTER THIRTEEN :

Off the Beach

AN ENGLISH NOVELIST, several years ago, wrote a book that had a deep and frightening influence upon the minds of men. The author, Nevil Shute, had written many vivid stories about the problems of our age—an age that has more questions than answers. This particular novel was built around an old theme: The end of the world and the ways in which men would face universal annihilation.

Considered coldly and factually, Shute's story has no relation to any possible future event. The catastrophe described in the book was caused by a world-wide conflict fought with cobalt bombs. These bombs do not exist. They would have no military usefulness. They would do their greatest damage not on the spot of a target, but around the globe; not immediately, but after the passage of years. The damage described in Shute's book could not have been caused by the bombs exploded during the war which, according to the narrative, results in the end of man. The cobalt bomb is not the invention of an evil warmonger. It is the product of the imagination of high-minded people who want to use this specter to frighten us into the heaven of peace.

In many other ways, Shute disregarded the real facts of life. Radioactive contamination is treated as a contagion. An exposed person—who actually could be decontaminated—is left to perish

Communists know they never will need to strike us in self-defense. But as long as the United States is unprepared to absorb and survive an all-out attack, the Communists have a temptation that might prove irresistible: A quick and easy nuclear victory over the nation most effectively thwarting their aspirations for world domination. If we are prepared for an all-out nuclear war, if we know we can survive the most vicious and widespread nuclear attack, if we guarantee our ability to rebuild our industrial complex after an attack, then the only valid reasons for a Communist attack upon our nation will have been removed. If we prepare, this disaster will never come.

A civilian defense system protecting people all across our nation obviously will be a tremendous undertaking, but it must be undertaken. The task looms larger because so little has been done. We literally must start from scratch, because this peaceful, nonaggressive guarantor of peace has been neglected for so long. The United States today has no comprehensive plan for civil defense, let alone adequate structures for civil defense. But at least the general outlines are clear, and we know that a plan can be written and a civilian defense complex can be built.

What must be done?

An adequate defense demands that we have early warning of attack, shelters, organization, clean-up equipment, and a plan for reconstruction.

Before we can begin to save ourselves from attack, we must know that an attack is coming. We must have as much warning as possible because our chances of survival would be measured in minutes. A rocket's travel time from a launching pad in Russia to a target in the United States would be only about twenty minutes. Fired from a Russian submarine, a rocket could strike a target in the United States in even less time. Without a fast and accurate warning system, an enemy rocket could obliterate

a large American city and its unsuspecting residents even before we knew we were being attacked.

The United States, fortunately, has established a complex and effective warning system. We have developed and are refining ways of detecting launchings from any part of the world as soon as the rockets rise into the air. Even more warning of an attack would save millions of lives, and more warning might be possible. The urgent need for the earliest possible warning of attack is one reason why observations of the whole world and all of the earth's activities—an "Open Sky" inspection from airplanes or satellites—have become so vital to our security. We have not yet attained an "Open Sky" inspection, but we have achieved a warning system that will tell us we are being attacked the moment rockets start to fly. So we can depend upon at least a little warning, and the short time we might have to save ourselves probably will not be shortened appreciably in the future because it would be exceedingly expensive to make rockets fly faster.

One of the most essential steps we must take is the establishment of reliable communications that would survive any attack. These communications should be used to warn our people of impending danger and to direct our essential post-attack efforts to save human lives and to recover from the blow.

In a sudden nuclear attack upon our nation, there can be no doubt that millions of Americans would die. But even the brief warning we would have if such an attack came tomorrow would be enough to save perhaps ninety per cent of our people—if they knew what to do in case of attack and had the means to protect themselves. The present warning system would alert our military establishment, but it would not save the majority of our people because they are uninformed about civilian defense methods and unprepared for survival. If we continue to neglect civilian defense, a nuclear attack on the United States could kill well over 100 million people. And the fate of the survivors would be no better than that of those who had perished.

In order to ensure ourselves against the horrors of such an attack by being thoroughly prepared for it, our people must be sheltered, organized, and educated.

Our most urgent need is a nationwide system of public and private shelters. To protect people in all sections of our nation from the expected and probable, a national program of shelter construction should be given at least as high a priority as any other project in our over-all defense effort. Detailed studies and plans are necessary. People in various sections of our nation will require different degrees of shelter protection.

Perhaps two thirds of our people live in the uncongested areas of our nation. Far from prime targets, people in these areas can be protected more easily. They probably would not be subjected to the blast of a direct nuclear attack. They might, however, be endangered by radioactive fallout of a very great intensity; after an attack, clouds of radioactive poisons could be expected to sweep over large portions of our country. They might also be exposed to conflagrations due to high-altitude explosions of the biggest nuclear weapons or carried to their neighborhoods by the winds.

Survival of people outside our cities would be favored by some circumstances: Time would be required for fallout to float downwind from the actual point of attack. In addition to the initial twenty-minute warning of an impending attack, these people could count on another half-hour, one hour, or even more time after attack before they would be endangered by fallout. This would give most residents time to protect themselves.

Effects of fallout often can be decreased simply by going indoors or taking shelter in a conventional basement. Protection almost always is sufficient in a fallout shelter built with thick but not necessarily strong walls and equipped with a filtered air system or properly designed ventilation. A reasonable measure of protection, in some rural areas, can be offered by simple shelters for individual families. These might resemble the storm cellars already built as tornado protection by many families in

our Central Plains states. Or rural families could build simple and adequate shelters by piling sandbags around the walls of a small building. The best protection, however, would be in community shelters. All the people in a small town probably would have time to reach a community shelter specifically designed to protect against fallout. Community shelters would offer greater protection at a lower total cost than a number of individual family shelters. And, because fallout might continue to be dangerous for some time, it would be best for entire communities to plan together.

Even though blast would not be a danger in these areas, fire damage is a real threat. This argues for construction of shelters that could survive a conflagration. It would be a further advantage if the shelters contained their own air supply. In many cases, it would be simpler to build the shelter in a location that would not easily be reached by fire.

In cities and prime target areas, the problem of providing adequate protection is much more difficult. People in our urban and suburban areas, like those in our rural sections, must be protected against fallout and radiation. But the people in and near our cities also require protection against nuclear blast and the even greater danger following the blast: Fire.

Civilian defense shelters in metropolitan areas and near important targets must be shock resistant. They should be surrounded with loose material that would dissipate the shock of a nuclear blast, and the shelters themselves should be rigid enough to withstand the shock penetrating the surrounding cushion. Dirt is an excellent shock cushion, and the most effective shelters will be built underground. These need not be deep. People in well-constructed shelters only ten to twenty feet below ground would have reasonable protection from a thermonuclear bomb exploding only one mile away. In shelters 100 to 200 feet below the ground's surface, there would be greater safety. In a thermonuclear attack we cannot ask for complete assurances. But we can and should save most people.

Effective protection against fallout, shock waves, and fire produced by a nuclear attack upon a metropolitan area also can be provided above ground. Our skyscrapers could be built around a windowless, rigid core of concrete made sturdy enough to withstand a blast's shock after it had been dissipated by the offices and corridors in the building's outer structure. These concrete cores would offer substantial protection. And they would be readily accessible to people in the most congested parts of our metropolitan areas.

People in cities will have only a brief warning of an impending attack. Therefore, every worker and every resident of every large city in our nation should be able to reach protection in a five-minute walk. Sturdy shelters should be built to accommodate everyone living or working within a quarter-mile radius of the shelter site.

It is important to realize that not all of the dangerous effects would be generated by each exploding nuclear bomb. Conflagrations over the widest areas could be kindled by very high altitude explosions which create no fallout hazard and which may not cause great shock damage. Air bursts of moderate height produce the widest damage through air shock, but would not damage well-constructed underground shelters and would not be likely to create concentrated fallout. The explosion producing really dangerous fallout would be a ground burst. This explosion also would cause ground shock and could damage underground shelters in the vicinity. But the air blast and the fires resulting from such explosions would cover smaller areas. In constructing shelters, it is important to assess which of these possibilities is the most likely.

Even in target areas, mass shelters can be built offering a real chance of survival for \$200 a person. On a national scale, an adequate shelter construction program would cost about twenty billion dollars. This sounds prohibitive. It is not. It is about half of our annual defense budget, and as a necessary insurance

against nuclear attack, the cost of adequate shelter protection is cheap.

The price of survival actually might be considerably less than twenty billion dollars because there is no reason for shelters to remain unused except in case of attack. Shelters can be built for more than one purpose. They can be designed and equipped to provide protection if protection is needed, but they also can have other functions.

It would be particularly important to build adequate shelters in our schools. It might even be advisable to contemplate building the schools themselves, with modern lighting and air conditioning, underground. On the surface above the underground school, children could have a really adequate outdoor playground. The underground school, of course, would be constructed and equipped as a mass shelter. There would be no problem of getting the children from classroom to shelter after an alert, and we would be reassured by the fact that our children were given the greatest safety. The cost of this shelter would be reduced by the amount of money that would have been spent on a conventional school.

Dozens of other kinds of buildings, similarly, could be constructed underground and serve dual purposes as housing for normal functions and as community shelters. We could make mass shelters of underground theaters and auditoriums, supermarkets, parking garages, warehouses, hospitals, or any other kind of structure that will accommodate many people. Concrete cores of office buildings, likewise, could be more than shelters. They could be garages, easing congestion in the hearts of our large cities. Garage cores have been built in office buildings in our country, and they have been found to be practical and convenient. Office tenants of the Redick Tower in Omaha, Nebraska, and the Cafritz Building in Washington, D.C., can drive into their buildings and park on the same floor occupied by their offices. These are examples of garage cores; to be shelter cores as well, they need only more sturdy construction. Our cities are the great

American repositories of culture. In our cities are the large museums, the most valuable collections of paintings and sculptures, the great libraries of books, the best examples of our cultural heritage. Many of these same cities would be targets for a nuclear attack, and such an attack probably would destroy these cultural achievements of man. I would propose that our museums and libraries be built underground and equipped as community shelters. In case of attack, such shelters would save many lives while preserving some of the chief reasons for living.

Multipurpose shelters may reduce the cost of this phase of civilian defense. But even at a reduced cost, the question must be asked: Who will pay for it?

I don't know the answer to this question. The main concern is that an answer be found soon. The full bill, certainly, would not come due in any one year. Three to four years probably would be required to build the kind of national shelter network we so urgently need. The costs might be paid by the federal, state, or local governments—or shared by all three. It surely would be improper for any new federal or local government buildings—post offices, schools, courthouses, office buildings—to be built without shelters. Much can be done to encourage private individuals and businesses to build shelters. The builders of new warehouses, bowling alleys, theaters, parking garages, or supermarkets might find it to their advantage to build underground if the government offered appropriate subsidies. Real-estate tax exemptions might prove strong incentives for shelter construction. Shelter needs differ from place to place; so while all shelters should be a part of a national plan, details could be settled advantageously on local levels—by states, counties, cities, private individuals, and companies.

If we are attacked, heavy radioactive contamination of the ground and atmosphere may force people to remain in their shelters for days and possibly for weeks. Each shelter should be stocked with enough food, water, and medical supplies to meet the needs of the shelter's occupants for two weeks. It would be a

very great help to have a filter system to remove radioactivity from air brought in from the outside, to have enough oxygen to provide an independent air supply for several hours—long enough to last through the fire storm—and to have chemicals which absorb the carbon dioxide exhaled by the occupants. Each shelter should also be equipped with an independent source of power to operate the air filter and to maintain radio communications with other shelters and with civilian defense headquarters. And, finally, each shelter should have a store of water and chemicals for hygiene; urban shelters should be constructed with several exits and stocked with dig-out equipment so their occupants would not be trapped by an explosion's debris.

A few days after an attack, people as a rule will be able to emerge from their shelters for limited times in limited places. Or they may have to remain in their shelters as long as two weeks. Shelters may have to serve as living quarters for months after an attack. Most buildings would be destroyed by an attack, and in many regions of our nation some radiation would remain, and time spent in these areas would have to be limited.

Shelters and equipment will not be enough for survival. We must have organization. All of our people should participate in a civilian defense training program. This is of the greatest importance. Every citizen must understand and practice civilian defense.

Either a limited or an all-out nuclear war would require the services of only highly trained, professional soldiers. General mobilization of manpower would be ineffective, unnecessary, and impossible. Instead of being available for conscription into the Armed Forces, our people should be drafted into civilian defense organizations. All should be trained in civilian defense fundamentals: All must know how and where to seek shelter. Once inside a shelter, our people must know how to organize for the safety of the group. They must be trained to follow the direc-

tions of a shelter leader and a shelter doctor. They must be trained to operate communications and air-filtering equipment. Before they can hope to emerge safely from the shelter, they must know how to measure radioactive contamination, and they must know how to wash it away.

An all-out nuclear attack upon our country would be terrible indeed. I do not believe it will come. But if it should come—and if we are prepared to shelter ourselves from its effects, if we are equipped and organized for survival—even an all-out nuclear attack would be no worse than some of the terrible events of past wars.

Radioactive contamination does not stay in the air over the target of a nuclear attack. It is blown away by the wind. It will pass over a given place in half an hour. Within three days of a nuclear attack upon the United States, airborne radioactivity would be blown away from our entire nation. But this is of little comfort because radioactive poisons, in addition to being blown away, can settle onto the ground.

The amount of radioactivity on the ground after an attack would depend upon the altitude at which the bombs were exploded and upon other factors. The post-attack fire storm, by creating an ascending air mass of considerable velocity, might help to keep the ground surface of a target area relatively clean of radioactivity.

But in planning our defense, we must assume that a nuclear attack would leave a good deal of radioactivity on the ground. A thermonuclear explosion would leave a city in rubble, and all or much of that rubble might be radioactive.

In urban areas this radioactive rubble could pose an additional threat to the survival of people who had been sheltered against the initial blast and the terrifying fire storm. In two weeks the radioactivity would have decayed to a level low enough to allow people to come out of their shelters and, in appropriate loca-

tions, resume work above ground. In the exceptional cases of very high radioactivity, bulldozers could be brought in and used to clean up essential areas or escape routes by pushing debris and topsoil aside. Radiation, in any case, will decay a little faster than the inverse proportion to the time passed. After one day, only three per cent as much radiation will remain on the ground as was there an hour after the explosion. After a week, the amount of radiation on the ground will be ten times less. After two months, the activity will be ten times less again.

We can save most of our people, and the survivors soon could turn to the problems of the new days to come. They must know what to do and how to do it.

While the majority of our people can be saved from an all-out nuclear assault, we cannot hope to save most of our goods or the factories that manufacture our goods. In an all-out attack, our industrial complex probably would be effectively destroyed. It can be rebuilt if we provide for its reconstruction. But it cannot be rebuilt and survivors of a nuclear attack will be without support and may face starvation if they have to start the task of reconstruction from scratch with no better tools than their bare fingers.

Much of the strength of our industrial society, fortunately, is not in our industrial plant. Our factories are expendable. Our strength is in our know-how and in our organization. Our gross national product, the value of everything manufactured or mined or produced in the United States, now is more than 500 billion dollars a year. But the total value of everything that exists in the country—all the houses, clothes, food, factories, minerals, farms, services, cars, everything that can be bought or sold—is only about 1500 billion dollars. Everything we have, in other words, could be produced by our present industrial complex in only about three years. This means our present standard of living is extremely high and our rate of consumption is prodigious. This

also means that survivors of an all-out nuclear attack, given food and a bare minimum of essential tools, could rebuild our industrial complex in a very short time. Even if our industrial plant were totally destroyed in an all-out attack, properly fed and equipped survivors living in austerity and working with complete dedication could rebuild our industrial plant to its pre-attack productive capacity within five years.

Just as we need to plan the construction of shelters to protect our people, we should begin a searching and exhaustive study of the things those people would need to survive after an attack and to rebuild our economy. We should plan and provide for our economic survival as well as for our personal survival. A thorough study must precede a complete plan for economic survival, but some potential needs already are obvious.

Survivors would need food. Shelters, hopefully, would be stocked with enough food to sustain people for two weeks after an all-out attack. This would feed them during their confinement in the shelters, but more food must be easily available after they emerge. Fortunately, we have a solution at hand. We have a national treasure that is considered an embarrassing political liability, but it could be converted into a great asset: Our agricultural surpluses.

The government today is storing enough surplus food to sustain the survivors of an all-out nuclear attack for perhaps two years. But it is not distributed so as to be available in all parts of the nation. It should be. Our surplus foods should be safely stored and located throughout the nation, making supplies of food available to all survivors. Wheat and other raw foodstuffs, furthermore, should be partially processed or stored with processing equipment so that survivors would not starve next to a filled granary.

Survivors would need tools and machines. These needs, likewise, can be met rather easily. Our government has moth-balled billions of dollars worth of equipment used during World War II and the Korean War, and we have stockpiled machine tools and

strategic raw materials. Most of this storehouse of equipment, tools, and materials would be useless during a nuclear war, but it would be most useful for survival after a nuclear war. Our moth-balled fleets, our desert dumps of outdated aircraft, our entire inventory of military surpluses and stockpiles should be carefully studied. Tools and parts and machines and materials that might be put to work after a nuclear attack should be distributed over the nation for safe storage.

Private industries should be given tax write-offs as an incentive to save equipment from the junk heap today for survival tomorrow. American industries are making steady advances in engineering and technology. Machines are being discarded and replaced as manufacturing methods are modernized. These workable machines should be stockpiled rather than junked.

We could store our old machines in simple, weatherproof, and widely dispersed structures. Fallout would not harm these machines, nor would moderate blast pressures destroy them. When needed, they would be ready for use. Equipment considered obsolete today would be invaluable to the survivors of a nuclear war.

Survivors would need transportation. Safely and speedily, they would have to be able to get to underground supply dumps of food, machines, and raw materials. Our systems of roads and national highways probably would not be destroyed by an all-out attack. But key links in our highway system probably would be knocked out. Our economic reconstruction would be accelerated if destroyed links in the transportation system could be repaired speedily. Repair equipment and materials should be safely stored near anticipated trouble spots. Materials necessary for the building of a simple pontoon bridge, for example, should be stored now near bridges likely to be destroyed in a nuclear attack. Our refineries and our stores of gasoline may be lost. But we could encourage each filling station outside our cities to store gasoline in a reasonably safe place now. If all these stations would carry

ten times their present stocks of gasoline, a small but valuable contribution to our recovery would have been made.

Survivors would need energy. Reconstruction of a factory would be of little use if there were no power available for its operation. Revival of our industrial capacity would be agonizingly slow if our people had to depend upon water wheels and other primitive power sources. Our best guarantee of an efficient and effective postwar source of energy would be the construction, now, of underground nuclear reactors. Most nuclear reactors today are built above ground, and must be enclosed in a gas-tight sphere for absolute protection against an accident that would release radioactivity. This sphere is expensive. Construction of reactors underground, where no sphere would be needed, would be not much more expensive and might be even cheaper than aboveground construction.

Many individual parts of our recovery plan must be worked out and fitted together. There can be no doubt that industrial production will eventually recover after a nuclear attack. But if we prepare properly, the recovery could be fast.

Survivors, above all, would need organization. They would emerge from their shelters into a kind of world man has never known. Millions would be dead. The standard of living, highest in history only two weeks before, would be near zero. Things our people long have considered as necessities suddenly would have become the hoped-for luxuries of the future. Life would be bleak and cheerless, and life's prospect would be the necessity of rebuilding our productive capacity before stored supplies of food were dissipated.

In such a world, people would have to live and work according to a plan. Teamwork would be essential. The pressing goal and aim of our people would be group effort and survival.

If we wait until we are attacked to plan our postwar organization, there is a very real danger that we might lose our individual

liberties and freedoms permanently. The postwar society will need rigid organization for its own survival, and rigid organization usually leads to tyranny.

If, on the other hand, we plan a postwar organization before we are attacked, our liberties can survive.

When young men and women join the Armed Forces today, they lose many of their rights as individuals. They must subject themselves to a rigid discipline. But they know that this discipline is only temporary. They know that when they leave the Armed Forces, their full rights will be restored.

It is this kind of postwar organization we must plan now. We must anticipate a strict state of emergency, but we must limit it to the time of the emergency. We must understand that during the critical five years after attack, when the needs of the group and of the nation are paramount, the individual will have to make great sacrifices. But we must guarantee that after the emergency has passed, after our economy has been rebuilt, our way of life, our right to the pursuit of happiness, will be restored.

We should define the necessary emergency measures while we can do so rationally and in freedom. In this way, we can be sure that the emergency measures will be properly limited.

Our almost total lack of civil defense is the weakest link in our national security, and so it is the greatest danger to peace. In an area where so much needs to be done and so much should be done, we have done practically nothing. Russia, on the other hand, has done much.

Our Office of Civil and Defense Mobilization says: "Official Soviet interest in new shelter construction has been apparent since about 1950. New building construction in some Soviet cities is known to include shelter as a matter of routine. . . . The impression is gathered that the inclusion of protective construction features in new buildings is a standard practice in many centers of population and industry, and that basement shelter of some

kind already is available to an important segment of the population of urban areas of the USSR." The average adult Russian is given about sixty-four hours of civil defense training each year. The Soviet government has distributed plans for "hasty shelters" that can be erected to protect Russian families against fallout within twenty-four hours after warning of an attack. An estimated fifty million Russians participate in some phase of the Soviet Union's civil defense program; the United States has only 2000 professional civilian defense workers, and private citizens now are given almost no training.

Even though Russia is struggling to build her economy, even though it is more painful for the Soviet Union to spend money for civilian defense, Russia has spent much more than the United States on shelters and on an effective civilian defense organization. Unless we change, unless we spend vastly greater amounts, it is likely that Russia would survive an all-out nuclear war and we would not.

It is useful to compare the economies of Russia and the United States. We are fat and Russia is lean. In a conflict, to be lean is an advantage. But our wealth can enable us to put things aside for a dreadful rainy day, helping to ensure that we will never meet the lean ones in conflict. To stockpile food and machinery for survival is incomparably easier for us than it is for Russia. We have surpluses. Russia does not.

Judicious stockpiling in the United States during the next few years would make it completely clear to the Communist nations that we could recover faster and more effectively after an all-out nuclear war than could Russia.

I believe that the Soviet Union is not anxious to participate in an all-out nuclear war for an important economic reason. The Russian people have made tremendous sacrifices to build up the Soviet industrial plant. Russians are proud of their new factories and of their new products, and they do not want to lose them. Those factories and those products are important Russian assets in their fight for world domination. With adequate civil defense

preparation and organization, we can assure ourselves and the world that after an all-out war the United States would be able to re-establish economic strength sooner than Russia—and so the United States would remain by far the strongest nation in the world. Thus every trace of motivation for Communist attack upon our nation would vanish.

Fortunately, our civilian defense effort is no longer completely paralyzed by fear and despair. On May 9, 1961, President Kennedy proposed to triple the budget. In New York State, after years of careful preparation, a vigorous program was undertaken by Governor Rockefeller. Throughout the nation, common sense and the will to survive have begun to reassert themselves. We are moving off the beach.

Even in case we are attacked, we can survive if we are determined and translate our determination into action. The first and basic objective of any defense is survival. If our individual and national survival is assured, we can proceed with confidence to build all the other bulwarks that are needed to maintain peace.

Development of lightweight, mobile retaliatory missiles would improve our chances of defense because such targets could be maintained as moving targets. Additional retaliatory bombs should be located in many solidly built and well-defended bases. It may be impossible to shoot down all approaching missiles. But if a missile has to make a precise hit on a missile base to be effective, there is a real chance for an anti-missile defense protecting a sharply defined point. Much thought and work will have to go into this second-strike force, but better nuclear explosives are the beginning and the end of every improvement. Smaller explosives will make our missiles more mobile and easier to defend. Better explosives will make the hard task of point-defense against missiles somewhat easier.

The plan to launch our counterattack only after we have been bombed decreases the chances of accidental war. But a second-strike force requires many retaliatory missiles which must be kept in constant readiness. This may seem to increase the chances of a tragic mistake. Actually, a great deal of thought has been given to devices which will eliminate the possibility that the human error or aberration of a single person in charge of a retaliatory missile could unleash a war. Using past accomplishments and future progress, we can make absolutely sure that our government has a restraining power and that as long as our government is functioning, only the most responsible persons to whom we have entrusted our fate can order a counterattack. Our strength would give these men the assurance that they never need act in haste.

On the other hand, we need not worry that the Communists can defeat us by knocking out our government and eliminating those empowered to order a counterattack. The safeguards against an unauthorized launching of our second-strike force can be so arranged that as soon as our government ceases to function, the safeguard also ceases to be in effect. With the country in

flames, the dispersed units would be free to do their duty and strike back.

The problem of creating a second-strike force that can *never* strike first but that can *surely* strike in retaliation is not easily solved. But it can be solved.

There remains a question that is most disturbing: What should we do if one of our closest friends were subjected to an all-out bombardment? What should be our reaction if England or Canada were attacked?

One possible answer would be our declaration of a limited war. We must try to limit the territory and the aims of such a war, and we must do all we can to help our ally without allowing the conflict to become world-wide. How this might be done will be discussed in the next chapter.

This answer may be logical. But it will not satisfy everyone. It does not satisfy me. Unfortunately, I could accept only one alternative. And this alternative, while probably the right one, is most difficult.

If two countries are so closely tied together that nuclear bombardment of one necessarily will lead to nuclear bombardment of the other, then these two countries in reality are not two but one. In this case, the policies of the two countries must be shaped by common participation and consent. Instead of two separate loyalties, there should be a single loyalty. The governments of the two countries in many respects may continue to function separately. But in the most important areas, in the questions concerning survival, there can be but a single government for the two countries. In that case, effectively and morally, an attack on one would be considered and announced as an attack on both. A union would in fact be created, and the ambiguous situation of an attack on an ally would be replaced by the straightforward demands of self-defense.

The stability of the world, in the long run, demands a suprana-

tional authority. It can be argued—indeed, it has been argued—that the time has come to establish a single government responsible for the survival of England and the United States right now. It might be possible and necessary to establish an even more inclusive union at the present time. My own belief is that such a step would be an early recognition of an inevitable development and would greatly increase the chances of continued peace.

The choices that are before us are not easy, and we cannot make progress toward a stable world without sacrifices. But this much is clear: Our position will be more firm, secure, and right if we establish a strong second-strike force and if we develop our ability to fight a limited war in order to defend our allies.

CHAPTER FIFTEEN :

Limited Warfare

THE KOREAN WAR TAUGHT the United States two great and valuable lessons. We would do well to remember them.

Conditioned by two global conflicts, the American people in 1950 had a big-war mentality. They could not conceive of a conflict limited both in political aims and in geographical area. The opinion prevailed that any kind of war almost automatically would become a world war. Korea, politely termed a "police action," was a practical and effective reminder that we could participate in a limited war without becoming embroiled in a world-wide catastrophe.

Korea taught the American people another and more bitter lesson, one that military leaders always had accepted as axiomatic: We should, if possible, avoid fighting on the enemy's terms. The enemy in Korea had tremendous advantages. He could select the place for war; he could set the time for attack; he could effectively dictate the scale and the method of war. Fighting an enemy with these considerable advantages, the American people learned that we cannot allow future enemies to dictate the terms of future wars. It was a difficult lesson to learn. It cost three years of hard fighting and 33,629 American lives. Still, it is not completely clear that we have learned this lesson.

The Korean War demonstrated these two important lessons, but it also implanted a grave misconception in the minds of most

Americans. At a time when we had a clear-cut atomic advantage over the enemy, President Truman stubbornly and steadfastly refused to authorize the use of nuclear weapons against Communist forces in Korea. Military men, anxious to use their most effective weapons to shorten the war, were unable to persuade the President who had taken full responsibility for the surprise nuclear devastation of Hiroshima and Nagasaki. He was adamant, and nuclear weapons were not used in Korea. Use of atomic weapons at that time, indeed, might have turned millions of Asians against us. But Truman's stand gave birth to an idea which has become generally accepted but which is, nevertheless, invalid: If neither side uses nuclear weapons, there is real hope of keeping the scope of a war limited; but the moment either side does employ nuclear weapons, nothing can prevent expansion of a limited war into an all-out nuclear catastrophe on a world-wide scale.

Korea established two precedents and proved two principles of limited warfare. We learned, in Korea, that wars can be limited in area: Rightly or wrongly, the area of fighting in Korea was limited to one side of the Yalu River. We learned that wars can be limited in their political aims: The fighting, clearly, was for Korea and nothing else. These precedents both are valid. But Korea also gave rise to the popular idea that a war can be limited only if it is non-nuclear.

This last idea is not only invalid but dangerous. The misconception that *any* use of nuclear weapons would expand a conflict and inexorably trigger an all-out global war has been accepted as an unquestioned fact by many of our highest government officials and has been a prime consideration in our international conduct and military planning. As a result, we have concentrated on preparations for a kind of war that I doubt will ever be fought again. We have continued to draft thousands of young men and have taught them to stand at attention and march eyes-right. We have continued to build and man aircraft carriers and other huge surface ships. We have spent billions of dollars on

conventional arms for a conventional force, acting on the assumption that wars in the future will be fought like wars in the past. History differs, and tells us that the ways of fighting wars change. But this lesson of history has been largely ignored, and we have continued preparations for a non-nuclear conflict at the expense of the development of the kinds of effective nuclear weapons and other military methods that surely will be employed in future wars.

We must recognize that Russia inevitably would have three overwhelming advantages in a war fought by conventional, historical means. The massive, disciplined manpower of the Communist countries has given the Soviet Union far and away the most powerful peacetime army in the history of the world. Russia is in a central, strategic location—near the countries in which a limited, conventional war would most likely be fought. And, finally, Russia is not unwilling to take the initiative.

The United States is strictly circumscribed by traditional and historical principles. Our people have strong feelings against aggression. Russia is not so circumscribed nor so hampered. On the contrary, Russia is opportunistic and is capable of grasping the initiative whenever a nation's internal politics or external defenses seem to assure Russian success. Combined with the Soviet's strategic location, this willingness to take the initiative would give Russia a tremendous advantage in a conventional war limited in scope to one of the nations on the periphery of the Communist empire. Before we could get our conventional forces to the front in sufficient numbers to wage a non-nuclear war, the Communist armies would be firmly entrenched.

Two imaginary future wars might demonstrate our alternatives. The outcomes are quite different, but they are not difficult to imagine because one or the other is being written by our military planners today. One outcome would be a death-blow to American prestige, and would lead to the eventual extinction of our

national government. The other outcome would enhance America's position of world leadership, guarantee our existence, and preserve our freedoms. We will consider the two distinct possibilities as histories:

A CONCISE HISTORY OF THE WAR OF BRAVADO

The country of Bravado was a small but strategically located nation adjoining Communist bloc countries near the Scrobean Sea. The democratic government of Bravado outlawed the Communist Party, but the Bravadonian Communists continued to function underground and attracted some support among student organizations.

On September 13, 1965, these Communists, in an internal uprising, usurped the established government and precipitated the War of Bravado, the shortest war in the world's history. The Communist uprising was well co-ordinated. Various Communist units, carrying small arms made in Russia, simultaneously took control of Government House in Scrobea, the nation's capital, and captured the city's two newspapers and three radio stations. Loyalist officials found just enough time, before fleeing Scrobea, to send an urgent message to Bravado's ambassador in Washington, X. G. Strunk.

Strunk won an immediate audience with the President of the United States. The mutual defense treaty between Bravado and the United States was invoked. The President, acting as Commander in Chief of the Armed Forces, ordered American troop transports and aircraft carriers to sea, then placed our Air Force bases overseas on an alert for a possible attack against the Bravadonian Communists. While our warships were steaming toward Bravado, the President called a special emergency session of Congress. He wanted the legislators to issue a Declaration of War before actual fighting began. As congressmen converged on the nation's capital for the historic session, Air Force reconnaissance planes roared from the runways of U.S. bases in England and

flew toward Bravado with rather ambiguous instructions to "report" on the "strength" of "Communist forces."

Three hours after Ambassador Strunk had called on the President to ask for U.S. aid, Radio Scrobea said that a large force of Russian paratroopers had landed in the capital of Bravado after a short flight from Communist territory. Within minutes after this report was picked up by U.S. radio monitors on Long Island, the Kremlin announced through regular diplomatic channels that Bravado was a Russian protectorate. The Soviet government recognized the new government of Bravado and warned all nations that it would be defended against any aggression.

Five hours after the President had acted on Ambassador Strunk's request for aid, the Air Force reported to the Pentagon that communications with U.S. reconnaissance flights had failed. The new Bravado government subsequently revealed, over Radio Scrobea, that the United States reconnaissance planes had been shot down as aggressors and that five surviving American pilots had confessed that they had been ordered to fly over Bravado as spies.

Congress had not yet convened in Washington. On the heels of Radio Scrobea's spy charges, the Kremlin issued Russia's famous White Paper. The White Paper formally accused the President of the United States of "shameless aggression" in Bravado. As a peace-loving nation, the White Paper declared, Russia was determined to halt any aggression that might lead to World War III. Russia would torpedo and sink any warships or aircraft carriers approaching Bravado with aggressive intentions, and would "regretfully" undertake the nuclear punishment of any nation that threatened the peace of the world. The White Paper vowed that if American forces were not ordered to return to American shores at once, Washington would be subjected to massive attack by nuclear rockets. The Paper concluded with polite diplomatic language asking the President to reconsider his "rash actions threatening world peace."

The President, knowing that Washington could not be ade-

quately defended against massive nuclear attack, complied with the demands of the White Paper. The War of Bravado was over. It had lasted less than one day.

Short as it was, the War of Bravado was the beginning of the end of world leadership for the United States. American prestige nose-dived throughout the world. In the months that followed, the United States Government passed legislation drafting men and women to bolster our cold-war effort, but the drastic attempts to build America's defenses against nuclear attack came too late. A little more than three months after the War of Bravado, on Christmas Day of 1965, Russian armed forces landed in Iran, Iraq, Kuwait, and Saudi Arabia. The governments of these countries appealed for American aid.

The President called Congress and the NATO high command into emergency sessions to choose between the alternatives: An abandonment of the Near East that would cut Europe off from its oil supply, or a declaration of war that would provoke an all-out attack on the United States and our allies—an attack which neither our nation nor the other members of NATO could survive.

The Near East was abandoned.

Three months later . . .

A CONCISE HISTORY OF THE CROSTIC UNION WAR

History's first limited nuclear war began on September 13, 1965, in the Crostic Union, a federation of strategically located provinces near the border of Russia. The Crostic Union War was launched when the outlawed Communist Party led a revolution against the established government of the Union. Within hours after the uprising began, the insurgents had captured the government buildings in the capital, Union City, as well as the capital's leading newspapers and radio stations. Leaders of the established Loyalist government, however, managed to escape to provincial cities.

Both sides called for outside aid. The Communist insurgents, entrenched in Union City, asked neighboring Russia to declare the Crostic Union a Soviet protectorate and to supply military support. Loyalist leaders in the provinces radioed their ambassador in Washington, Dr. Magharta, to secure immediate aid from the United States under terms of a mutual defense treaty between the two countries.

Both Russia and the United States acted swiftly. Three hours after Soviet aid was sought, Russian paratroopers floated down over Union City to give ground support to the rebel forces. The Soviet Air Force gave the paratrooper transports more than adequate protection with fast fighter jets. On the diplomatic level, Russia recognized the rebel government in Union City and declared all of the Crostic Union as a Russian protectorate. A Russian army of 100,000 men began marching toward Union City.

In the United States, the threat to world peace was met with equal effectiveness. Congress, years before, had given the President and a small permanent committee from the House and the Senate the power to declare war by Executive Order anywhere in the world—providing that the war was limited in area and in scope, neither of which could be enlarged without provocation from the enemy and without subsequent ratification by Congress. While the President received the ambassador from the Crostic Union, the situation in Union City and the facts of Russia's intervention were confirmed by our Central Intelligence Agency. The President, by Executive Order, immediately declared war. In the declaration, he limited the fighting area to the boundaries of the Crostic Union. He carefully limited the political scope of the war to re-establishment of the Loyalist government. He affirmed that the United States would use all the means at its disposal to achieve these objectives.

The President's declaration set the well-oiled machinery of the Pentagon into action. No warships or aircraft carriers were launched. Military planners, in fact, had decided years before that such cumbersome and slow-moving ships would be nothing

but good targets in a nuclear war. But great numbers of transport planes took off from bases within the continental United States and flew toward the Crostic Union at speeds that would have been thought impossible four years before. These planes were armed with atomic air-to-air warheads. In fierce nuclear dog-fighting over the Crostic Union, both Russia and the United States suffered air casualties. But about a hundred United States transports got through Russia's air-to-air barrage and dropped 3000 American commandos over the Crostic Union. Strategic supplies, including lightweight nuclear weapons, were parachuted along with the commandos. The United States commandos spread over the country to perform the job for which they had been thoroughly trained: Organization and leadership of Loyalist guerrilla fighters.

The United States and the established government of the Crostic Union had worked diligently over the years to plan the military defense of the small nation. This careful planning paid off during the world's first limited nuclear war. The airborne commandos knew where to contact Loyalist leaders, and knew exactly where small arms had been cached for Loyalist guerrillas.

The Russian army of 100,000 marching double-time from the border to Union City, the only Communist stronghold in the nation, met only guerrilla resistance—with one devastating exception: United States commandos assembled one of the lightweight nuclear weapons which had been parachuted to them and destroyed a large supply depot upon which the advancing army depended.

Russia, through diplomatic channels, immediately objected to the use of nuclear weapons in the war. The United States replied by pointing to its declared intention of using all possible weapons against strictly military targets during the limited war. When the United States ambassador to Moscow delivered this reply to the Kremlin, the Soviet Premier was beside himself with rage. He pounded his desk with both fists and shouted that if one more

nuclear weapon were used in the Crostic Union conflict, an all-out nuclear retaliation would be hurled against the United States.

The Russian ultimatum was received in Washington. Before replying to Russia's nuclear threat, the President ordered the United States on a nationwide atomic alert. The country was ready. Civilians quickly moved into bomb shelters that had been constructed near their homes and the places where they worked. Previous peacetime drills had taught them what to do in such an emergency.

The President also alerted our second-strike force—an arsenal of nuclear warheads aimed at Russia from nuclear submarines, airplanes, and mobile launching pads in the United States.

And then the President rejected the Russian ultimatum.

The United States preparedness took the teeth out of the Russian threat. The effective alert left the Russians no strategic reasons for bombing the United States, no hope of inflicting damage that could not be eventually repaired, no hope of crippling the nation. The poised second-strike force was recognized by the Kremlin as a counter-ultimatum. Russian leaders nobly announced that the peace-loving Soviet Union would not plunge the world into war by bombing the United States.

Russia turned her full attention to the war for the Crostic Union. The rebel Communist government controlled only the capital, Union City, but Loyalist guerrillas aided by American commandos controlled the rest of the nation. Neither the guerrillas nor the American commandos presented targets large enough for nuclear weapons. The Soviet Union found it impractical to use her most effective arms at any time during the war except in the air-to-air missile battle over Union City. This air battle was fought by the Russians to protect Soviet planes dropping food and supplies to rebel forces in Union City, which was besieged by Loyalist guerrillas and American commandos. Russia, equipped with better fighter planes and better air-to-air nuclear missiles, was winning the air battle over Union City; but American commandos using nuclear ground-to-air missiles downed

many of the Soviet's flying boxcars. Russia determined to break the deadlock siege of Union City, and 400,000 Soviet troops poured over the border into the Crostic Union. Natives in villages along the border, who were in sympathy with the Loyalist cause, reported the Soviet troop movements to American commando teams in the area. United States forces used nuclear bombs to halt the massive Russian land attack. Those Soviet soldiers who survived the nuclear attack retreated beyond the Russian border.

Russia withdrew all land and air forces from the embattled country, and then went before the United Nations to brand the United States as an aggressor against the government of the Crostic Union and to protest America's use of nuclear weapons during the limited war. The United States proposed in the United Nations that the world organization should oversee free elections in the Crostic Union, elections in which all parties, including the Communist Party, could sponsor candidates. The free election was held on the day before Christmas 1965, and Loyalist officials who had been defended by the United States were returned to office by an overwhelming majority.

The conduct and consequences of these fictional conflicts are easy to imagine, because they accurately reflect the difficulties now faced by the United States. If a localized, brush-fire war should break out almost anywhere in the world, Communist forces would have the tremendous advantages of concentrated manpower, centralized location, and an initiative devoid of moral considerations. To overcome these dangers, the United States would have to use every means that technology can give us. Among modern weapons, nuclear arms stand out because of their light weight and unmatched power. They would give us the high degree of mobility we would need to stop Communist aggression anywhere.

Why, then, has the United States not planned and prepared to use nuclear weapons in limited warfare?

Four powerful objections have convinced most of our people that nuclear weapons should not be so used. They are the following:

Any use of nuclear weapons would provoke nuclear retribution. If nuclear arms were used in limited warfare, the localized conflict would grow into an all-out nuclear holocaust engulfing the world.

Nuclear explosions would leave the scene of a limited war in total ruin, and a people would not want to be defended if it meant their destruction.

The United States, in the final analysis, could not hope to win a limited nuclear war because the Communists also have nuclear weapons. With nuclear arms available to both sides, we could not hope to neutralize the Soviet advantages of manpower, location, and initiative.

The United States actually is not prepared to fight a limited nuclear war, so we cannot engage in this kind of warfare.

These four arguments are so popular and so persuasive that each deserves a detailed discussion.

First, make no mistake: We do not like or want limited wars. We do not want any kind of war. But the horrors of war can be limited, and if some conflict is inevitable, we should strive for limitation. We must do everything in our power to prevent local conflicts from becoming world-wide catastrophes.

Any limitation, to be effective, must be clear-cut and enforceable. Limitations on weapons are extremely difficult to enforce, but limitations of the territory and aims of wars have had frequent success.

Most people, when they think of nuclear weapons, think of mushroom clouds and massive destruction, of dramatic after-effects that would make it easy to determine whether a conflict's restriction to conventional weapons had been violated. So, in the

popular mind, the use of nuclear weapons has become the line of demarcation, the detectable shutoff point of a war's enlargement. But the development of new tactical weapons and the possibility of using plentiful small nuclear explosives against relatively minor targets make this shutoff point less impressive, less detectable, and therefore less enforceable. Radioactive fallout might diminish or disappear with development of "clean" bombs. New scientific surprises might be used in battle, and the attacked might not know what hit him—a nuclear or a non-nuclear weapon.

Retaliatory nuclear attacks would be made on the basis of guess, suspicion, and rumor. And, once nations are at war, even the craziest rumors are accepted as facts. During the Korean War, for example, many of the world's peoples believed the outrageous accusation that the United States had resorted to bacteriological warfare. And during World War I, the American people got fighting mad over the fabricated report that Kaiser Wilhelm had ordered his troops to cut off the hands of Belgian children. It would be too easy for the commander of conventional forces in a war limited to conventional weapons to say that he had been driven to the edge of defeat by an enemy using illegal nuclear arms. At that point, nuclear weapons might be used without previous planning. An unplanned expansion of the war may indeed have tragic consequences, and the limits of these consequences would not be easy to foresee.

Although limitations on the weapons of war are very difficult to enforce or maintain, wars can be limited in geographical territory and political aims. The losing side in any war is strongly tempted to use the most effective weapons to turn defeat into victory, but the last to want either the area or purpose of the fighting enlarged. Weapons cannot be limited, because this kind of limitation assumes that the defeated will consent to defeat. But area and aims can be limited and have been limited.

The United States would want to maintain the limitations of a conflict whether we were winning or losing. The Communists

would want to limit the territory and aims of a war if they were losing. Lenin recommended, many years ago, that Communists faced with heavy odds should take one step backward in order to take two future steps forward. This has been preached to Communists and practiced by Communists. It has become a Communist doctrine, and Communists would accept defeat in a limited nuclear war without attempting to enlarge the war's scope, hoping they could consolidate their forces for future advances. But the Soviet Union would be tempted to expand the scope of a limited war if they were on the victorious side, and this we might be unable to prevent. The defeated cannot prevent expansion of a limited war's scope. Precisely for this reason, our best insurance against expansion would be our preparation and willingness to fight a limited war with whatever weapons are most likely to win.

To be effective, limitation of a war's geographical and political areas must be announced. Whenever the United States is drawn into any conflict, we should recognize and proclaim that our wartime effort would be conducted in a specific territory for specific purposes, and we should make it clear that we would not take the initiative in expanding either. If Communist forces should again push over the 38th Parallel in Korea, for example, our clearly stated objective in fighting might be to liberate all Korea. If another Asian nation were attacked, our stated purpose in declaring war might be purely defensive. If we undertook the armed defense of West Berlin against Communist aggression, we probably could not fight for anything less than for all of Germany. In any case, the area of the limited war would be circumscribed by our objective in fighting.

Russia, before moving to expand Communism anywhere in the world, would have no knowledge of the United States counter-move in each specific situation. The price for a move into West Berlin might be the potential loss of all Germany. But Russia would learn the price only after its move had been made and

the President had declared a limited war, stating the United States' objectives and limiting the area of the fight to win those objectives. We would be bound by these limitations, however, only as long as they were respected by the Communists. They would realize that every Communist expansion of the conflict beyond our stated limitations would expose them to additional and unknown risks. This uncertainty would greatly reduce the likelihood of a limited nuclear war and of its expansion. In fact, the worst time for the Soviet Union to undertake a further expansion of Communism, the worst time for Russia to touch off a world-wide nuclear war or launch an all-out attack upon our nation, would be at a time when a limited nuclear war was in progress. At that time, we would be most alert and least likely to be caught off balance.

Our best insurance against a nuclear attack upon the United States, however, remains civilian defense and the establishment of a second-strike force. The very existence of this force of hidden, poised, invulnerable missiles would serve notice upon the Soviet Union that if we were attacked, Russia could not escape attack. A strong second-strike force would deter the Communist temptation to disregard the limitations of a localized war. Our ability to survive an initial attack and rebuild our economy would make a Russian assault upon our nation futile.

If we are prepared and can survive, I am convinced that we will not be attacked under any circumstances. And our strength and passive preparedness will give us a reasonable guarantee that a limited, localized nuclear war will not grow into a global conflict.

The second objection to limited nuclear warfare is that it would leave the territory of the fighting in ruins. A limited nuclear war conducted by the United States, according to this argument, would kill the people we were trying to save and destroy

the country we were trying to defend. And what, after all, is liberty without life?

This argument disregards the nature of nuclear warfare and of nuclear weapons. It assumes that wars of the future will be fought like wars of the past.

Strategic bombing contributed to our victory in World War II. It interrupted the mass production that supplied massive armies, and broke transportation systems connecting factories with the front lines. Strategic bombing left the World War II armies of the enemy like the hands of a man with the blood vessels and the muscles of his arms severed.

Strategic bombing was effective in the last great war. But it does not follow that it would be effective in a limited nuclear war. Cities will not be arsenals for future wars, and fighting men no longer will depend upon lines of supply. There would be no military justification for the large-scale bombing of cities and transportation systems. Fighting forces in a limited nuclear war would be widely dispersed and highly self-reliant. They would not need materials being manufactured in cities' factories, so the cities themselves and the country's transportation network would not be important military targets.

Nuclear weapons used in limited warfare, as a matter of fact, would do no more damage to the face of a nation than conventional weapons. They might, indeed, do considerably less damage. The United States today has nuclear weapons in great numbers and in a great variety of sizes. We can adjust weapons to the specific purpose for which they are intended. For example, we can conceive of a nuclear explosive so small that it could be fired by one man from a weapon similar to a bazooka against a target no larger than a single tank. The amount of additional destruction, in the firing of either conventional or nuclear weapons, would depend upon marksmanship.

Our fighting forces in a limited nuclear war would not be measured in battalions and divisions. They would consist of commandos, and in each group there would be as many as fifty or

as few as five men. They would be air-dropped, air-supplied, and if necessary, air-evacuated. American forces fighting a conventional kind of war for the liberation of an ally, on the other hand, would consist of many thousands of men in the front lines of battle, and they would depend upon long lines of supply furnishing them with hundreds of thousands of tons of the materials of war. These supply lines themselves would be military targets; their defense would depend upon additional multitudes of soldiers. A conventional war thus would be fought not only at the front, but also along the lines of supply. This kind of warfare converts an entire nation into a huge battlefield. This has happened again and again in our century. And this inevitably would do more damage to the face of a nation than would a nuclear war in which the battle for liberation would be fought at specific points on the ground and the battle of supply would be fought in the skies.

Although cities and transportation systems would not be military targets in a limited nuclear war, although the nuclear weapons used by the participants may do no damage beyond military needs, although small groups of fighting men would not be as destructive as massed armies, there remains another reason to fear that even a limited war might lay a nation to waste: Cities might be bombed to frighten citizens into submission.

The devastation of cities and the planned annihilation of civilian populations in a limited war cannot be justified. And it seems likely that psychological bombings might be ineffective; the survivors of such attacks might emerge more enraged than terrified, as they did from the London blitz. There is serious doubt about an indiscriminate nuclear attack's psychological effect, but no doubt about the effect it would have upon world opinion. Any nation considering a terror raid would have to weigh its value and consequences. The wise decision would be not to provoke the anger of the world but to preserve the face of the nation embroiled in the war.

According to the third argument, the United States could not hope to win a limited nuclear war because the Communist forces would also be equipped with nuclear weapons.

Actually, with both sides using nuclear arms, we cannot hope that nuclear weapons alone will win wars for us. But they will enable the United States to fight limited wars on our terms. They will give us a chance to win conflicts that otherwise would be lost.

Our nuclear power would force dispersion of any massive Communist armies. Our lightweight, easily transported nuclear weapons and our ability to rush small groups of fighting men equipped with those nuclear weapons to troubled areas would eliminate the Communist advantage of location. Our ability to move fast and to strike effectively would reduce the Communist advantage of initial action.

It is now generally accepted that in order to participate effectively in brush-fire wars, the United States must develop and train guerrilla forces. If we should try to use guerrillas without using nuclear weapons in the conduct of a conventional war, the small and dispersed groups of fighting men would be overwhelmed by the concentrated armies of the enemy. But nuclear power would change the war's character. It would make concentrations of enemy manpower completely impractical, and at the same time it would multiply the effectiveness of our dispersed guerrillas. Armed with nuclear weapons, very small groups of American fighting men could spread over the countryside and could destroy any military target—including a marching army of enemy soldiers.

Nuclear arms used by our hit-and-run guerrilla fighters would not win a war by themselves. Our ultimate success would depend on the people for whom we would be fighting. They would have to be with us. They would have to give us information on enemy tactics and troop movements, take up arms themselves, and defeat the enemy dispersed by our guerrilla forces.

The United States could not be confident of victory in a lim-

ited war fought within the borders of a nation whose people were not wholeheartedly on our side, where the majority actually was inclined toward Communism, or even where most people simply were apathetic about Communism and unwilling to fight for freedom. America's determination to contain Communism, to prevent the Soviet Union from using ambiguous aggression and outright attack to conquer the world, is predicated on the assumption that the peoples of the world would rather be free than enslaved. We must be sure that this assumption is correct before we allow ourselves to become involved in any limited nuclear war. Our success in any such war would depend upon the support and active participation of the people in the involved nation.

The powerful strength of a home guard of freedom fighters has been demonstrated again and again throughout history. In the beginning of our own national history, freedom-loving men used inferior arms and equipment, guerrilla tactics, and a great deal of ingenuity to defeat the superior forces of the British. In 1956, the dedicated zeal and largely unsupported efforts of patriotic Hungarians won a brief, bitter victory for freedom. At the beginning of the Hungarian revolt, when a single Russian tank no longer was safe in Budapest, Russian soldiers realized that the popular will was against them, and they no longer wanted to fight the people. These Russian soldiers were withdrawn and replaced with fresh forces that concentrated tanks south of Budapest for a single assault that crushed the Hungarian revolt. The success of freedom fighters against individual tanks and dispersed forces showed the effectiveness of a home guard. Their failure before a concentrated array of tanks demonstrated the limitations of even the most zealous unsupported force. If concentrations of enemy forces can be prevented, the will of a determined people is going to decide the outcome of any future limited conflict.

According to our ideals, we should support only nations controlled by true governments of the people. But we also have supported strong-man governments, dictatorships and monarchies,

that could not claim wide popular support and were in no way governments of the people. Since success in any limited nuclear war would depend upon the people of a foreign country and not upon the titular head of that country's government, we should cement relationships and improve our position by increasing military and economic aid to governments fully supported by the popular wish. Conversely, we must never make the suicidal error of attempting to defend a government that is not supported by the people and whose leader is afraid to put weapons into the hands of his people.

We never must try to protect a people from Communism if the people want Communism. Our best international defense against war is an international desire for freedom. The ideological conflict that has engulfed the world can be bloodless. We can win the battle with Communism for the hearts and minds of men. If the people of the world really want freedom and are on our side, and if our nuclear forces can stop massed Communist manpower, I am convinced that our victory would be assured in any limited war. And with our victory assured, I believe that the Communists never would provoke such a war.

Three of the objections to limited nuclear warfare are invalid. A limited nuclear war, I am convinced, would not automatically trigger an all-out global conflict. The battleground of a limited nuclear war would not be left in utter ruin. We could win such a war if the people of the embattled nation were on our side. A last objection remains to our participation in limited nuclear wars: We are not prepared for it.

I must agree that this final objection is correct. At a time when limited nuclear warfare looms as a distinct possibility at any of a half-dozen of the world's troubled areas, the United States in truth is not prepared to participate, and the truth of this unpreparedness is frightening. The United States today would be totally incapable of declaring or fighting a limited nuclear war. We

are unprepared politically, diplomatically, militarily, and psychologically.

We must prepare politically. If provocation for a war comes, the United States must be ready to move fast. We must prepare to do this by slashing through the red tape now required to place the United States in a state of war. The President should be empowered by Congress to declare war on his own initiative at any time and at any place in the world to achieve limited and predetermined purposes. Congress should retain the right to criticize and ratify the presidential decision, but should not be required to make the split-second determination to fight a limited nuclear war. The Departments of State and Defense, in consultation with other affected governmental agencies, should outline several limited objectives for each of the many possible provocations for war before hostilities actually begin. American forces waging wars under presidential declaration should not exceed these limited, predetermined objectives. Purposes and goals of our fighting would be different in each possible situation, and up to the time the President made a decision between alternative objectives and we entered the conflict, the enemy would be ignorant of our demands as victors. Investment of new powers in the presidency is a legislative matter. Assessment of the extent of American interests in each of the danger spots of the world is a matter of administrative consideration and mature judgment. Both are necessary ingredients of political preparedness.

We must prepare diplomatically. The necessity for home-guard support for our commando forces in a limited nuclear war will inevitably dictate a change in America's international diplomatic posture. Since victory would depend so largely upon other people, we must make diplomatic preparation for war by improving understanding and co-operation. Our allies must realize that their freedom depends on their own people. They also must be firmly convinced that we can help to defend them from a concentrated onslaught of their enemies.

We must prepare militarily. This preparation will be difficult and will have many aspects.

The United States today does not have the best possible arms and does not have the military organization that would be needed for the successful waging of a limited nuclear war. The prevailing American philosophy of mutual deterrence has prevented proper preparation for limited wars. We have concentrated on big weapons for big nuclear conflicts. Some good work has been done on small, lightweight nuclear weapons of the type that would be used in limited warfare, but in this field the future possibilities greatly exceed the present accomplishments.

The little work done in the field of advanced weapons has been secret, but one phase has been discussed publicly: Development of a "clean" nuclear explosive producing little or no radioactive contamination. Suppose the Soviet Union were the first to develop the kind of "clean," lightweight nuclear device needed in the conduct of a limited nuclear war. The Communists probably would give the new device a new name, perhaps the "Peace Bomb," and proclaim to the world that its use in limited warfare would ensure world peace. If the wind did not carry radioactivity from their "Peace Bomb" to harm innocent, neutral bystanders, people would be inclined to accept the bomb's new name and the Russian claim.

Since our military unpreparedness gives the Soviet Union a good chance of winning a limited nuclear war, I believe that such wars must be expected. If wars are to be avoided, we must lower the chances of Russian victory. As a first step toward preparedness, the United States must develop small, "clean" nuclear arms that would be needed for limited nuclear conflicts.

Technical and scientific problems, however, are not the most difficult we face in creating our capability for limited warfare. Another problem is human. It will be more difficult to train the commando forces required for limited nuclear wars than it will be to develop "clean" nuclear devices. We must train men to be self-reliant, courageous, resourceful, technically capable of work-

ing with jeeps, communications systems, and atomic weapons. Each individual commando must shoulder a great responsibility. He must be able to help and if necessary to guide the fighting efforts of home-guard guerrillas in foreign lands. He should be educated in the language, habits, and histories of foreign peoples so that he can feel at home among native populations and distinguish friend from foe among the people of the embattled country. Development of such an intelligent, high-caliber commando will require a radical departure from present military training methods. This means that we must assign some specially trained commandos to each area in the world.

If any nation can organize a fighting force of this type, I believe it is the United States. Our young people grow up in a mechanical tradition, and we have trained men to repair transportation and communication equipment in the field; we also should be able to train men to assemble and operate nuclear weapons. Because the United States is a melting pot, we should have little difficulty in recruiting men for a nuclear army who would be willing to understand, accept, and appreciate the traditions of other peoples. And in America, self-reliance of the individual is a virtue; unlike the young people of Communist countries, Americans are taught to despise regimentation and to stand on their own feet. Development of the kind of army needed to fight a limited nuclear war may be impossible. But if it is possible anywhere, it is possible in the United States.

We must prepare psychologically. Since the devastation of Hiroshima, the American people have convinced themselves that any use of nuclear weapons constitutes all-out war. This erroneous notion must be corrected before we can begin to prepare for limited nuclear warfare. The American people, as well as free people throughout the world, must be educated to the fact that wars are divisible, that we can limit the scope of war, and that the use of nuclear weapons in a war limited in territory and purpose would not lead inevitably to a global nuclear disaster.

Surmounting this psychological barrier may be more difficult

than any other problem we face in the necessary preparation for limited nuclear warfare. Of all inert things, the human mind may be the most inert. We must overcome this inertia, because only if we can change the way people think about nuclear weapons and nuclear wars can we ensure the stability and peace of the world.

young democracy in America. It seemed, at the time, to be an unimportant creation in a distant corner of the world. But when Alexis de Tocqueville came from France and studied this remarkable development, he concluded his penetrating and sympathetic criticism with prophetic sentences:

There are at the present time (1835!) two great nations in the world, which started from different points, but seem to tend towards the same end. I allude to the Russians and the Americans. . . . All other nations seem to have nearly reached their natural limits . . . but these are still in the act of growth. . . . The conquests of the American are . . . gained by the plowshare; those of the Russian by the sword. The Anglo-American relies upon personal interest to accomplish his ends and gives free scope to the unguided strength and common sense of the people; the Russian centers all the authority of society in a single arm. The principal instrument of the former is freedom; of the latter, servitude. Their starting-point is different and their courses are not the same; yet each of them seems marked out by the will of Heaven to sway the destinies of half the globe.

While we reaped the sweet and bitter fruit of the past, we sowed a fertile field for the future. New sciences appeared. The way was opened to an understanding of electricity and magnetism. The secrecy and confusion of alchemy gave way to a systematic study of the transformations of matter: Chemistry. The cellular structure of living things was discovered, and mere classification of living beings was replaced by ideas of correlation, kinship, and evolution. Lamarck spun theories of how the giraffe had acquired its long neck; a few years later, an English naturalist traveling on the ship *Beagle* wrote in his notebook observations of the strange Gardens of Eden he found on Pacific isles. His notes were destined to change the position that man had assigned himself in the scheme of things.

But all this was prelude. In the next century, 1845 to 1945, more changes took place than most of us realize today; more scientific progress was made than most of us understand.

The future of science is open, and I envy those who enter it with fresh minds.

When we worry about the future, we usually do not think about science, but about the human society. And about the future of mankind, we can talk with the hope that springs from the story of the last 300 years. Amid many doubts one prediction can be made with confidence: The human race, at the end of our century and beyond, will still be here. Frequent and gloomy prophecies to the contrary are not justified. The fear of mankind's end is not based on fact. It is based on a monstrous anxiety.

The world of 2045 will be more densely populated than ever. There will be close to ten billion people on the earth. The industrial revolution will be completed, and the incredible multitudes crowding the world will live in reasonable comfort. Life will go on, and the necessities of life will be available.

In an age of many independent sovereignties, Alexis de Tocqueville predicted, correctly, that Russia and the United States each would sway the destinies of half the globe. By the year 2045, this process will have been completed. All the peoples of the world will bear allegiance to a single government. Our present uncertainties revolve around questions concerning this one government of man. What kind of government will it be? What is the road leading to a United World?

At the end of World War II, the United States was at the zenith of its power. Only we possessed nuclear weapons. Our fabulous wealth had not been diminished by the world-wide conflict. Backward nations, recognizing that the United States had grown rich and powerful through its own efforts, looked to us with the hope that our accomplishments now could be repeated on every continent. American scientists formed the vanguard in the exploration of the unknown. American history was the bible for those who devoutly believed in freedom. It

seemed a foregone conclusion that the years between 1945 and 2045 would become known as the American Century.

Less than two decades later, our power is dwindling, our leadership is challenged, and our wealth is considered the result of luck. American affluence is the object of envy and contempt. American technology is being outstripped in space. The great respect that our country once enjoyed is hardly remembered.

This tragic change has been accompanied by general discouragement in the United States. A strange fact is that the discouragement did not follow the decline of our strength and prestige. It preceded the decline. We seemed to turn our eyes from an inspiring past and a challenging future. In the unfolding of human accomplishment and human power, we could see only danger—and we seemed unable to accept the fact that danger always has been a companion of change. It is of great importance to understand, if at all possible, the source of our present weakness, the cause for the eclipse of the American dream.

It is a most critical moment in the life of an individual if there is a sudden transition from protected childhood to the responsibilities of a grown man. The change may appear too difficult. The challenge may be a shock. There is a real danger, at such a moment, that the young mind may turn away from reality and its superhuman demands. The spirit may seek refuge in a make-believe world and deny the existence of the problems and difficulties that caused the dilemma.

Psychiatrists are well aware of the symptoms accompanying such a flight from reality. Memory is repressed. Meaningless substitute-actions take the place of purposeful endeavors. Rational behavior is replaced by anxiety, by feelings of guilt, by fears of improbable and fantastic calamities.

Neither logic nor any other type of scientific reasoning can justify application to a nation of the things we know about individual behavior. Yet I am reminded of these violent and

dangerous growing pains of young men when I think of our difficulties in facing the atomic age. Hiroshima deprived us of the ocean barriers that had protected us. Hiroshima shattered our traditional policy of isolation. The United States was projected into the unaccustomed role of leadership in a gigantic struggle—a responsibility which the great majority of Americans did not want and for which we certainly were not prepared. This situation was created by our own actions. We had no workable plan, and we faced the problems of the atomic age with feelings of awe, guilt, fear, and anxiety.

Two years after the end of World War II, I was discussing the United States defense policies with a clergyman in Chicago. He insisted that our nation never would use nuclear weapons for mass destruction, even if that were the price of our own survival. He maintained that the deep-grained moral convictions of the American people never would permit the use of such ghastly weapons. I could make only one reply: "We actually have used them."

He said no more, leaving me with the indelible impression that he wanted to forget Hiroshima. I am convinced that many Americans feel the same way.

We argue that questions of nuclear warfare are too technical for general understanding, that they must be left to the experts. We believe that problems of nuclear explosives must be handled secretly, that they cannot be settled by public discussion. There is some validity in these arguments. But, at the same time, we are in a situation where the great mass of Americans have refused to shoulder a responsibility that belongs to the citizens of a free country. Perhaps the real reason for this behavior is that many want to avoid responsibility; the decisions that must be made are too awesome. We tolerate secrecy in a democracy and leave atomic questions to the experts because we prefer not to think about our difficult problems.

We are neglecting civilian defense. The very real possibility of a nuclear attack is too terrible even to think about. It certainly

is too terrible to deal with or plan for, although preparation would eliminate the threat. Rather than concern ourselves with dangerous realities, we have substituted an imaginary danger. Worries about our unpreparedness have been replaced by fears of radioactive fallout produced by nuclear tests and dangerous only in the imagination. This is like a person relieving his tensions by the act of washing his hands again and again.

We insisted on trying to draft an agreement with the Russians to end nuclear tests. The effort was fruitless, and it was doomed from the beginning. We know that such an agreement could not be policed, and we know that it would not remove the danger of nuclear conflict. Yet we seemed eager to accept a symbol that might help us to imagine that our danger had decreased. Now it is apparent that the Soviet Union conducted secret nuclear experiments during the test-ban negotiations, increasing our danger. It is obvious that the Soviet Union prepared for an important series of atmospheric tests conducted late in 1961 even while test-ban negotiations were in progress. But many Americans, unwilling to face these facts of Russian duplicity, continue to seek a test-ban treaty that would be unenforceable but that would stand as a comforting symbol.

At the same time, we have continued to raise our standard of living. The great majority of the people in the world are starving, but we have managed to increase our own well-being by almost 50 per cent in less than two decades. Although our survival is closely allied with the fate of all men in all parts of our world, we prefer to live as if we alone existed.

In a dangerous situation, we have chosen the most dangerous of courses. We have chosen not to face our danger.

What needs to be done will not be easy to do. But whatever the difficulties, a few tasks clearly must be accomplished.

We should be prepared to survive an all-out nuclear attack.

We can and we should have adequate shelters for our entire population.

We should have plans and stockpiles so that after an all-out attack, we could recover. If we are adequately prepared, the attack never will come.

We should abandon all plans to deter Communist expansion with the threat of massive retaliation. We should, however, maintain secure retaliatory forces to make sure that any all-out attack against our nation could be answered with a crushing counter-blow.

We should be prepared to respond to limited aggression at the same level at which the attack is made. We can and should limit the area and aims of such conflicts. We cannot and must not try to limit the use of weapons.

We should develop our tactical nuclear weapons and our mobile forces to the point where concentrations of invading armies can be defeated and other strictly military targets can be wiped out. For the winning of a limited war, we must rely on the local people fighting to defend their freedom.

We should accelerate scientific and technical efforts that will lead to future military strength. We need more work on developments of nuclear explosives. Only with continued preparedness can we ensure peace long enough to build the foundations of a stable world order.

We should give full support to peaceful research in many fields, including meteorology, oceanography, and the use of nuclear explosives in geographical engineering, to release the riches of the earth and speed the day when all peoples can share in the fruits of the industrial revolution.

We should pursue the exploration of space and rally the interest and work of other nations to make, together with us, a united effort in man's latest adventure.

We should strive for a gradual abandonment of governmental secrecy in scientific and technical fields so that our people once again can have a full voice in the affairs of our nation.